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VIEWS, NEWS AND INTERVIEWS.

Papa is lighted by electricity. Papa is a town in Hungary and a firm of Austrian contractors has just installed an electric lighting plant in the place.

A German socialist organ, *Vorwarts*, draws attention to the latest development of electricity. It states that an electrical firm in Berlin has received orders from St. Petersburg to submit samples of microphones, intended to be fixed in the walls of cells in prisons, in order to repeat everything spoken by the prisoner in any part of the room.

A long distance telephone line has been recently opened between Odessa and Nicolaieff, Russia.

One of the novelties shown at the Crystal Palace Electrical Exhibition is a bamboo molding for concealing electric wires. It can be handled just as ordinary molding and is capable of being worked into designs, besides being artistic in appearance.

It is not generally known that Edison received in one instance a fee of $40,000 for his opinion as an electrical expert, says *The Sun*. He was employed by the company organized to bore the Niagara power tunnel to examine the ground, study conditions and plans, and give an opinion as to the feasibility and practicability of the work. He received the fee named. Other experts from various parts of the world were also consulted, and there was concentrated upon the plans an amount of expert knowledge such as has rarely been invoked for any one undertaking.

When electricity becomes the motive power on the elevated roads, and the properly protected guards, in their boiled shirts, become universally polite, a miniature millennium will arrive for Colonel Hain, and another, many sizes larger, for the public.—*New York Commercial Advertiser.*

The electrical steering gear of the monitor "Miantonomah" is now said to be in good working order. The apparatus was designed by the Edison General Electric Company, and as this is the first time such apparatus has been applied to a monitor, which is the hardest of all vessels to steer, it required a little time to get it working properly. The electrical equipment of the "Miantonomah" is probably the most complete of any of our war ships.

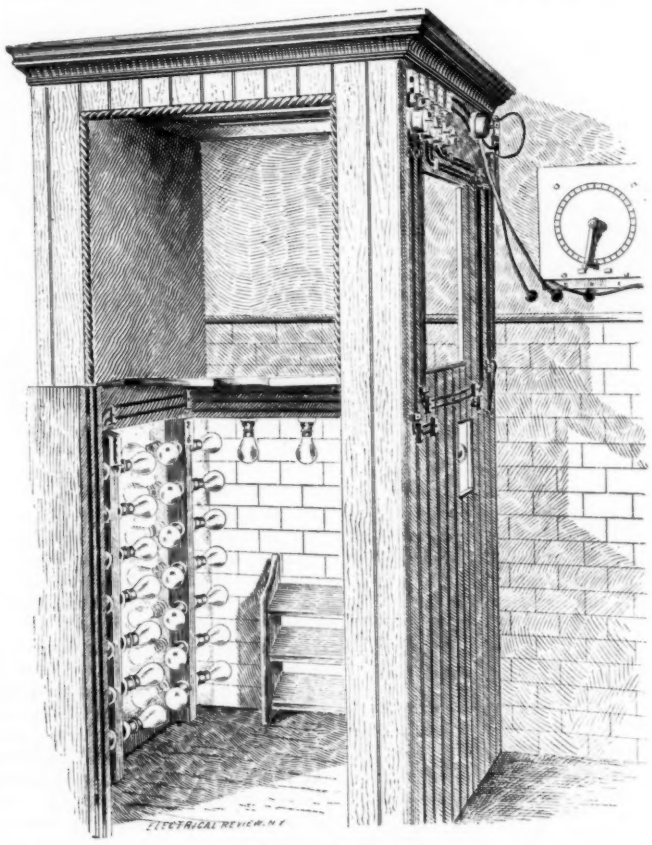
Dr. Louis Bell, the well known electrical engineer of this city, has won the Winans trophy for revolver shooting, and with it the amateur championship of America.

What a blessing it would be if Col. Elliott F. Shephard's Fifth avenue stages could be operated by electricity. The car horse has been emancipated by the trolley; cannot the good work be extended to the rescue of the poor stage horse?

The main office of the Thomson-Houston International Electric Company will be removed from Boston to New York with headquarters in the Edison Building, in Broad street.

An Electric Light Bath.

People connected with the electrical industries are not in the habit of being surprised at any curious or unique development the application of the electric current may take. But we think that the device just completed by William G. Reuter & Company, of Cincinnati, will be a surprise to everyone. It is nothing less than an electric light bath, which is not to be confounded with an electric bath. The illustration on this page shows the device in detail. The cabinet is of the usual size of vapor baths with a lid enclosing the body completely, except the head, which is exposed. The lamps are distributed around the body of the patient, being arranged in groups of 14 and operated by a separate switch for each group.



AN ELECTRIC LIGHT BATH.

About 60 lamps of 16 candle-power each of 110 volts are used in the bath. The sides of the interior of the cabinet are backed by polished nickel to give reflective power. A physician has made some tests of this bath, and has reported that the temperature of the patient in 10 minutes rises to 148 degrees. After a bath the effect of the strong light is to brown the skin as if it had been exposed to the sun. The combined effects of the sun and vapor bath in one are said to be without the usual depressing effects of the vapor bath alone. In fact, it has an opposite effect, making a patient buoyant and frisky. The switches and resistances are arranged to throw on section after section of light, or to throw off light as desired, each section, of course, adding to the light and heat of the bath. As to the medicinal effects of such a device we are without information, but the matter is presented as a novel and, perhaps, beneficial application of the incandescent light. If the inventor could arrange such a bath for the head and arms of a patient, it might meet with a ready sale among those who cannot afford a Summer trip, and who yet wish to present a sun-burned appearance in the Autumn.

Electric Railway at Oskaloosa.

The Consolidated Street Railway and Light Company, of Oskaloosa, Ia., was organized May 31. The incorporating directors are C. A. Ross, Eli H. Chandler and Charles Ffrench, of Kansas City, Mo.; Alexander Simes and H. L. Chandler, of Philadelphia; Geo. W. Seevers and C. Winter, of Oskaloosa, Ia. The company owns all the horse car lines in the city of Oskaloosa, and will make extensions to connect the towns of Carbonado and Beacon with Oskaloosa. The reconstruction work and changing over to the trolley system will begin about the middle of this month.

New England Electric Club.

The monthly meeting for June was held Monday evening of last week. A review of the transactions of the Club from the date of the first meeting was presented. The next evening a musicale by the Botolph orchestra was given. Both occasions attracted a large number of members and their friends.

Telephonic Underground Construction in the Northwest.

BY C. P. WAINMAN, OF MINNEAPOLIS.

While frequent mention has been made of the progress of underground construction in various cities of the United States, little, if anything, has been said regarding the subject as applied to Minneapolis and St. Paul, the "Twin Cities" of Minnesota.

It is not, however, to be supposed that these cities, with the push and energy which has made them so remarkable in other respects, have neglected a matter of so great importance as the placing underground of the various classes of electrical wires.

It is not the intention of this article, however, to deal with the subject except as it relates to such construction for telephonic circuits.

The telephone business of both cities is managed by the Northwestern Telephone Exchange Company, whose general headquarters are at Lowell, Mass.

The construction of an underground system was begun in 1889, the officials of the telephone company having, after a thorough and careful investigation of the merits of various systems in use in other cities, decided in favor of vitrified earthen pipe, which was being used by the Chicago Telephone Company, and which has now come into very general use throughout the country.

This conduit, as is well known, consists of a square pipe divided by a lateral shelf into two compartments or ducts, each about eight by three and one-half inches in size, and capable of holding three cables of 100 pairs each.

The conduit is made in sections of three feet in length, which are joined by a wrapping of five thicknesses of burlap cut in strips about nine inches wide and saturated with hot asphaltum. With this wrapping properly applied, a length of three sections (or nine feet) has been supported at each end and weight applied until the pipe has broken, without the joints showing any signs of giving way.

In preparing the conduit for laying, three sections are joined together at the yard and in that shape distributed alongside the trench in which it is to be laid.

The trench having been opened to the proper depth, usually about four feet, and a perfect grade established between manholes, the pipe is laid, an excavation made where the sections are to be joined of sufficient size to permit the passage under the pipe of the rollers with which the saturated burlap is to be applied and the joint made in place. If more than one pipe is laid in the trench they are placed side by side or over each other, as may be necessary, a space of about four inches being left between the pipes for the purpose of making the necessary joints, which space is afterward carefully filled with earth and thoroughly tamped.

After all pipes have been laid the trench is filled level with the top of the upper pipe and well tamped. A mortar of one-third cement and two-thirds sharp, clean sand is then spread over the pipe to a depth of three inches and allowed to extend three or four inches beyond the sides.

The trench is then filled up, flooded or

tamped and pavements relaid. It has not been found necessary to prepare any wooden or cement flooring for the pipe and a covering of cement has been preferred to one of plank.

The manholes are located at street and alley intersections. They are constructed of best, hard brick laid in cement, the walls being one foot in thickness. In Minneapolis they are five feet square inside and are about six feet in depth.

In St. Paul they are of the same depth and thickness of wall, but are only five by four feet.

Covers are square with an opening of 30 inches. A groove cast in the cover into which is fitted a rubber gasket making the manholes water-tight. Whenever the character of the soil is such that any water which might find its its way into a manhole would be likely to remain and accumulate, the bottom of the manhole is slightly dished, well covered with cement and connection made with the sewer through a drain pipe and valve, so that any water can be drained out.

Ventilation is provided for by connections at various points with chimneys of high buildings.

The above is the character of the work in Minneapolis and in a portion of St. Paul.

A large portion, however, at the latter city, is built upon a strata of very hard blue limestone, varying in thickness from three to 15 or 20 feet and this limestone approaches so near the surface as to make it practically impossible to lay conduit in trenches.

Beneath the limestone lies a white sandrock of many feet in thickness and quite soft as compared with the limestone stratum. The construction of an underground system in this portion of the city, without incurring an unwarranted expense, was a source of considerable anxiety to the officials of the Telephone Company until it was suggested that possibly a tunnel might be drifted through the sandstone and shafts sunk from the surface to connect with it, some of the city sewers having been constructed in that manner. Investigation showed the plan to be feasible and that the expense would not be unreasonably great. A contract was thereupon made for the construction of a tunnel about 500 feet in length, the dimensions to be five and one-half feet in height and three feet in width.

It being necessary to pass under one of the main sewers, a shaft was sunk to a depth of 34 feet at each end of the proposed work, and from each of these points the drift was made at the rate of about 10 feet per day. Upon the completion of the work by the contractor the tunnel was found to be entirely dry and the air perfectly pure.

The result of the experiment was so entirely satisfactory that last year another tunnel over 3,000 feet in length was constructed, which differs from the one above described only in being six feet in height, thus giving ample space for walking upright, which was not the case with the first.

Along the side of these tunnels are fastened racks about 10 feet apart, and upon these the cables are hung. About midway of the last tunnel a chamber 10 feet high and about 10 feet square has been excavated in the sandstone for the purpose of placing transposing boxes on through cables. Distributing cables are carried to the surface through manholes, or small holes can be drilled from basements to the tunnel if desired. The whole work is the admiration of all who have examined it, and it is probably impossible to duplicate it anywhere in the United States.

The total underground system of the two cities comprises at present 212,305 feet of duct and 3,500 feet of tunnel, the cable capacity of the latter being practically unlimited.

The cables used are the Faraday, made by the American Electrical Works; the Patterson, made by the Western Electric Company; the Standard, of Pittsburgh, and are all of 65 pairs.

As metallic circuits have not yet been introduced, the conductors are used singly, and about 1,550 miles of conductor have been placed.

Distribution is made partially by underground connection through areas and partially from poles in alleys. Boxes for local distribution are placed in manholes at necessary points. They are constructed of cast-iron 18½ inches long, 6½ inches wide and 6¾ inches deep, inside measurements.

Around the inside of this box, and midway between the front and back, is cast a flange which is accurately planed to a level surface and to which is firmly screwed the diaphragm, which thus divides the box into two compartments. This diaphragm is of hard rubber three-fourths of an inch thick. Through this are bored 260 holes, three-sixteenths of an inch in diameter and tapped with a deep, strong thread. Into these holes are tightly screwed brass pins 2¾ inches in length, projecting about one inch on each side of the diaphragm. Over these pins is slipped a strong paper tube to prevent any possible contact with any conductor except the one which is to be attached to its particular pin.

The edges of the box and the plates which form the front and back are planed true, a thin rubber gasket placed between and the plates and box firmly bolted together. Each box is tested with air pressure to discover any leakage from sandholes or other defects and any imperfect ones are rejected. Into each end of the box and opening into the rear compartment is screwed a nipple, through which passes the main cable, the lead sheathing of which is connected with the nipple by the usual wiped joint.

Through the top are bored two holes 1¼ inches in diameter, one opening into each compartment, by means of which either or both compartments may be filled with paraffine, vaseline or similar substance if desired. These holes are, of course, provided with screw plugs for closing.

The bottom of the box is fitted with similar openings, through which the paraffine or other material may be drawn off if necessary.

In making connections, the box is laid face down and the back plate removed, the ends of the cable brought through the nipples and the joint wiped.

The conductors are evenly distributed as far as the center of the diaphragm, and securely soldered to their respective pins. The back plate is then replaced and the box affixed to the manhole, by clamps. Under ordinary circumstances it is not expected that this compartment will have to be re-opened. The front plate is now removed, and the pins to which are fastened the through wires are connected by jumpers, arranged in such order that any wire may be found at once. If the cable is very long, wires are transposed to eliminate cross-talk. The front compartment is fitted with two nipples, which enter from the top instead of the end, as in the back, and either or both of these may be used for small cables for local distribution, any required number of wires being taken out, either in loops, pairs or singly as may be desired, joints being, of course, wiped as with the main cable. Similar boxes, but of smaller size, are used where a large number of wires are carried into one building.

The outer ends of the cables are connected in the ordinary manner to a cable head, which is enclosed in a galvanized iron box fitted with safety fuses and lightning arresters. Each fuse is so arranged that in case it is burned out a light spring makes a contact with a wire connected with a battery of two cells in the central office and completes a circuit which informs the chief operator that a line is open in a certain cable and by throwing the subscribers drop upon the switchboard designates the particular conductor which is open, thus enabling prompt repairs to be made.

A considerable extension of the systems in each city during the present year is contemplated and the foregoing account of work already accomplished shows that the northwest has reason to feel that it is well up with other sections in the march of improvements in this direction.

Want the Trolley in New York.

The Ninth Avenue Street Railway Company, of New York, has petitioned for the privilege of applying the trolley system to the street railway on Columbus avenue from Sixty-fourth street to 110th street. The petition has been referred by the Board of Aldermen to the railroad committee.

Electro-Medication.

BY E. W. MURRAY, M. D., IN THE "TIMES AND REGISTER."

That medicinal substances can be introduced into animal tissues by means of the galvanic current, I have thoroughly proved to my own satisfaction. But that this can universally be done by applying the medicament at the positive pole, as commonly taught, I deny; and base my conclusions upon experiments which I have recently made upon living tissues and upon raw beef.

That fluids may be made to traverse the tissues in the track of the current from the positive pole to the negative, I concede; but that medicinal substances, which may be in solution in the fluid, accompany it, is not always true.

I assume that the rationale of electro-medication depends upon this law:

A solution of an electro-positive agent should be applied at the positive pole, because the negative pole attracts it; and, for like reason, electro-negative solutions should be applied at the negative pole.

The electrical relations of the elements and their compounds may usually be quite readily determined by reference to an electro-chemical series such as may be found in some of the published works on medical electricity.

To substantiate the truth of this principle more thoroughly in my own mind, I have recently made the experiments above referred to, using glass cups with metallic connections, and applying the medicinal fluid directly to the skin or tissue to be acted upon. When at a loss to determine the chemical relationship of the medicine, I suggest applying it at both poles. The organic compounds should, I think, always be applied at both poles, to insure the medicinal effect of the entire substance. This plan, too, is advisable in applying other easily decomposed compounds; for example, iodide of potassium and chloride of sodium. In such instances, it is possible, with a current which is but slightly painful, if the electrodes are of fair size, to produce an electro-chemical decomposition of the compound, in the case of iodide of potassium, free iodine appearing at the positive and potassium hydrate at the negative pole.

My recent experiments with iodine and iodide of potassium solutions follow:

Experiment 1: In the negative cup, iodide of potassium solution, one part of the latter to two parts distilled water. Reaction neutral. In the positive cup, distilled water. Reaction neutral. The cups were now applied to the surface of the tissues, three inches apart, and a current of 5 ma. passed for 10 minutes.

The contents of the negative cup is now found to be alkaline; that of the positive is acid and responds faintly to the starch test for iodine. In fact, the distilled water has now assumed an orange tinge, due undoubtedly to the presence of iodine.

Experiment 2: In the negative cup, iodine solution. Reaction acid. In the positive cup, distilled water. Reaction neutral. The cups were applied as before, and a like current used for the same length of time, when the contents of the negative cup was found to be neutral, while that of the positive was now acid; responds to the starch test and is of a deeper orange hue than in Experiment 1. The iodine solution which was placed in the negative cup has now entirely lost its color and is as clear as crystal.

Experiment 3: In negative cup, distilled water. Reaction neutral. In positive cup (made by diluting the alcoholic tincture with water to saturation; filtering of the precipitate), iodine solution. Reaction acid.

Application as before. In negative cup reaction is now alkaline and the fluid is still clear. No response to starch test. The alkalinity I attribute to absorption of that property from the fluids in the tissues by the negative electrode. In positive cup no change apparent.

Experiment 4: In both cups iodide of potassium solution. Reaction neutral. After the usual application the contents of the negative is now found to be strongly alkaline. The clear solution in the positive cup has now become deeply colored with the iodine tinge, is acid in reaction, and responds to the starch test for iodine. The skin underneath this cup is stained with iodine, while no discoloration is found at the sight of the negative.

To recapitulate, these experiments prove:

1. That iodide of potassium is decomposed at the negative pole, the iodine going to the positive.

2. That iodide, simple, passes from negative to positive.

3. That iodine, simple, cannot be made to pass from positive to negative.

4. That iodide of potassium is decomposed at both poles, iodine going to the positive and potassium hydrate to the negative.

Electro-medication is of undoubted value in many diseased conditions, prominent among which are glandular enlargements, such as goitre and hypertrophied tonsils. In a case of the former, which I discharged four months ago as approximately cured, the gland has continued to decrease in size until it is now wholly within the normal limit, and so much more rapidly has the gland decreased than the skin has contracted that the latter shows several prominent wrinkles.

I have also had excellent results in reducing tonsillar hypertrophy by this means, but it is more tedious than the galvano-cautery puncture. I employ the method, however, in small children in which the hypertrophy is still recent in preference to the cautery, which is to be preferred in cases of long standing. I apply the cups (electrode) back of the angle of the jaw, using iodide of potassium in both, but changing the direction of the current every other sitting.

Changing the Badge.

The National Electric Light Association, whose proceedings provide so many excellent papers, have as a badge the well-known formula $C=\frac{E}{R}$. In view of the Thomson-Houston-Edison combination and the proposed amalgamation of the Edison Association with the National, it is suggested that the badge ought now to be $E=\frac{T}{H}$.—*London Electrical Engineer.*

The World's Fair Incandescent Lighting Contract.

Mr. George Westinghouse, Jr., on June 4 signed the contract recently awarded to him for supplying the World's Fair with 92,000 electric lights at $4 25 each. Mr. Westinghouse at that time still objected to the requirement of the $1,000,000 bond, and made efforts to bring about its reduction. His argument was that the bond was excessive as compared with those demanded of other contractors, and that he would suffer injury by reason of the suspicion which such a bond implied. On June 6 the bond was reduced to $500,000, which presumably is satisfactory to Mr. Westinghouse. This transaction, therefore, settles one of the largest contracts for electric lights ever signed.

Women Decide Against Electric Lights.

One of the most exciting elections in many years was held recently at Weedsport, N. Y., when the taxpayers voted upon the question of bonding the village for $12,000, permitting the town to own and operate its own electric lights. Women were permitted to vote at this election, the bill introduced by Assemblyman Adams, and passed by last legislature, giving this privilege. The fight was bitter, and many personal encounters occurred. The village had been thoroughly canvassed months previous by a leader of the anti-bonders and, in fact, a leader of those who are opposed to any village improvement. He saw that nine-tenths of the ladies could be induced to vote against bonding by introducing the scare of high taxes. So it was put on as an amendment to the electric light bill. About 50 of the most enterprising and respectable young men of the village purchased a piece of land, entitling each one to vote, but the result was infallible, and the ladies, numbering 125, voted, with a few exceptions, against bonding, carrying it by 72 majority.

Of Interest to Electrical Exhibitors at The World's Fair.

It is the purpose of the Exposition management to allow exhibitors to completely equip the Electrical Building for lighting and power. With a view to determine just what may be done in this direction, the department of electricity chooses to place its plans before those who are interested in its success, and advise with them, as nearly as may be, with a view to give them an opportunity to participate in this equipment.

Under the rules of the exposition it will be necessary to plant all operating machinery in what is to be known as the general power plant in Machinery Hall, 700 feet from the Electrical Building. All generators will be established at that point immediately adjacent to steam power of competent capacity. Between this power plant and the Electrical Building there is a subway six feet deep and six feet wide for the accommodation of conductors. Fire proof vaults will be built at the point of entrance to the Electrical Building in which to install transformers, to comply with the National Underwriters' requirements. Headway averaging seven feet under the flooring, and foundation posts at intervals of 12 feet will give ample wiring facilities.

It is the purpose to divide the building into equitable sections, and to assign these sections to the various exhibiting interests. Those to whom assignments are made will be expected to install their own generators, furnish cables between the plant and the building and do all wiring—including the furnishing of wire. Those who are given arc lighting to do will be expected to furnish carbons, and attend to renewing same. Those undertaking to operate incandescent lamps will be expected to furnish all renewals and attendance. In addition to these items of expenditure, all exhibitors whose generators are operated from steam in the power station will be asked to pay, *pro rata*, the costs incident to the erection of the machinery. Belting from shafting to generators must also be furnished by exhibitors, and exhibitors of alternating systems will be asked to contribute to the expense of constructing the transformer vault.

The building will be equipped for 500 horse-power for the operation of motors, 500 horse-power for arc lights, 500 horse-power for incandescents and a reserve of 500 horse-power for extra incandescents, applications for most of which are already in.

In order that the plant for this building may not be a source of expense to the Exposition management, a charge will be made for any special arc lighting desired by exhibitors who *do not* participate in the equipment and electrical supply of the building; also against the same class of exhibitors who desire power for motors, or who require incandescent lamps. These charges do not concern any who contribute to the expenses cited above.

A New Cable.

We shall pretty soon have news of the successful laying of the new British cable between Africa and Brazil, the next British cable after that between this country and the Bahamas, says an editorial writer in the New York *Sun*. It is a fact that the great majority of the submarine cables of the world are in British hands, just as the greater part of the commercial steamships on the high seas of the world are in British hands. These cables are made by British ingenuity, laid by British enterprise and owned by British capitalists. They are in the Atlantic, the Pacific and the Indian oceans, as well as in the lesser seas, and they make London the telegraphic center of the world. The British submarine surveyors have recently found a practicable route for a cable between Japan and the British Canadian provinces on the Pacific coast of North America, thus preparing the way for direct telegraphic communication between this continent and the Asiatic continent. The Japanese-Canadian cable will follow in the wake of the new Japanese-Canadian line of steamships.

Africa will presently be connected with Brazilian America, and Asia will soon be connected with Canadian America, as Europe is now connected with the United States. Looking at the lines from Europe to Asia, to Africa, to Australia, to South America and to North America, we cannot help seeing how largely they are British in their origin and in their ownership. It is the British who are the chief cable layers of the world.

It was an American who, more than a quarter of a century ago, laid the first cable across the Atlantic Ocean. We have not done our proper share of the business of cable laying since that time. The Central and South American Telegraph Company, a New York corporation, has done good service within recent years, in laying cables that now run as far south as Valparaiso in Chili, and we believe that its enterprising President, Mr. James A. Scrymser, may soon undertake several other important projects in other waters.

The British cables under the seas are very serviceable to British commerce over the seas. They are advantageous to British manufacturing interests and to all the British industries, and to British power.

We shall very surely have several new ocean cables of American construction within the next few years. It should never again be necessary for American cable layers to send abroad for their cable lines; and we may here take occasion to make the remark that Americans should also construct their own commercial marine, so that it shall never again be necessary for us to go abroad as purchasers of foreign built ships.

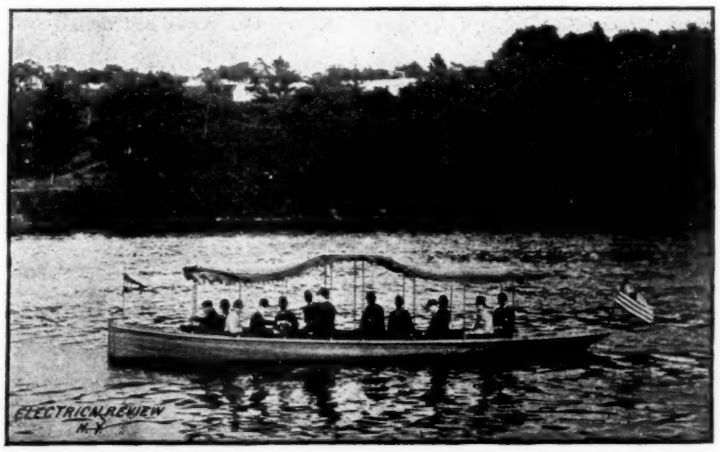
Electric Launches for the World's Fair.

The illustration presented herewith shows the "Electra" on the Passaic River, at Newark, N. J. The cut was made from a photograph taken by Mr. Fred. Reckenzaun during the "Electra's" trial trip, a full account of which appeared in the ELECTRICAL REVIEW of June 11. The launch is to be sent to Chicago at an early day to perform before the World's Fair Commissioners.

Competition for the privilege of operating launches on the enclosed water ways of the World's Fair is quite lively, the following firms having entered bids: The Electric Launch and Navigation Company, of New York, owners of the "Electra;" The Columbia Launch Company, of Chicago; C. P. Willard & Company, of Chicago, and Meaker & Proctor, of New York.

Chief Burnham has granted a 30 days' trial to these contestants and at the end of this time the company having the most satisfactory system will be awarded the contract. There are electric launches, steam launches, gas engines and naphtha launches being exhibited on the lagoons, but so far it is probable that the most satisfactory launch is the electric. It gives more room for passengers than the others, and the disagreeable smoke and noise are lacking.

Last week the Columbia Launch Company presented an electric launch for the inspection of the commissioners. It was built for the Columbian Launch Company, and fitted up by the American Battery Company, of 177 La Salle street, Chicago. The equipment of the boat consists of a five horse-power Jenney motor placed under the aft deck, the armature of which is connected direct to the shaft of the screw. The power is supplied from 104 of the American Battery Company's storage cells of the Plante pattern. The cells are coupled up in two series of 52 each, and by means of a very ingenious switch, 13, 26 or 52 cells can be thrown in, giving the boat three rates of speed. The boat can also be reversed at the three rates of speed mentioned. The maximum speed of the craft is 10½ miles an hour, which can be reduced at pleasure. The boat will carry about 40 passengers. After going through four and one-half miles of lagoons, to further test her powers, she was put out into the lake. The lake was somewhat rough, but the little craft acquitted herself admirably.



THE ELECTRIC LAUNCH "ELECTRA" CARRYING REPRESENTATIVES OF THE PRESS ON THE PASSAIC RIVER, AT NEWARK, N. J.

An Electric Club for Manchester.

A meeting was held at Manchester, N. H., June 3, for the preliminary organization of an electrical club. Geo. I. Hopkins presided and a constitution and by-laws prepared by Supt J. Brodie Smith, of the Manchester Electric Light Company, were adopted. After discussion the meeting was adjourned until a future date, when a permanent organization will be effected.

The Electric Sugar Frauds.

The defence in the electric sugar cases was begun May 31, at Ann Arbor, Mich., with Henry Hack on the stand. He told of Cotterill urging that Friend's death be kept secret. He told of going to the secret rooms in the factory with Cotterill, Howard and MacDonald from Scotland.

Mrs. Olive Friend, the defendant, was also a witness. She and Friend were married in February, 1883. That Summer Friend told her about his secret process, and took her to a place he had rented and showed her the machinery and demonstrated the methods. She claimed that the machinery was different from the models shown by the plaintiff, and had electric wires attached. Friend used some preparation on the sugar before it was placed in the crusher, which made it sparkling white and purified it.

Her attorney asked her to explain what this was, and she refused, claiming that this was her secret. She said their claim was to purify all grades of refined sugar, but not raw sugar. Several drafts of contracts were presented, showing that Cotterill knew that the Friends would not contract to refine raw sugar.

American Society of Civil Engineers.

The annual convention of the Society will be held at the Hygeia Hotel, Old Point Comfort, beginning Wednesday, June 8. Satisfactory hotel accommodations have been arranged for. A number of interesting papers are down to be read and several enjoyable excursions have been planned.

The Pennsylvania Railroad will carry delegates from this vicinity on a special train composed of three vestibuled parlor cars, one vestibuled dining car and a baggage car, all arranged in the most approved Pennsylvania Railroad style. About 100 delegates will leave here on the Pennsylvania special, and others will be picked up at Trenton and Philadelphia.

Electricity and Fires in England.

All the ills that flesh is heir to have been ascribed to electricity. It is such a mysterious agent, and the public imagination is easily captured by mystery. So the public thought it might have caused the fire at "Scott's," and they called in an electrical expert named—well I have forgotten his name, who at first acknowledged he knew nothing about it, but gradually told the coroner and jury how electricity might cause a fire, and how rats and mice have something to do with electricity, and how it means danger to have an electric light wire run in a certain position, and by dint of guessing at what might have been, this electrical expert half convinces himself, more than half convinces the coroner, and probably has succeeded in convincing some people forever that the fire must have been caused by electricity.

The public need not be alarmed at such statements, says "Meteor," in London *Lightning*. There is nothing safer than electricity, and its use is one of the best preventatives against fire. English contractors are now too well acquainted with the ways of fire insurance inspectors to run any risk of having their work condemned, and the necessary precautions are so simple that every honest firm adopts them without compulsion.

I have often heard the "Phœnix" Office rules abused as unnecessary and vexatious, by members of the profession who should rather regard them with gratitude. They are the best safeguard we have against accidents, and the fact that no single case of fire from electricity can be proved to have occurred in England since they have been in operation is not only a credit to Mr. Heaphy, who devised them, but an enormous source of profit and advantage as well to electric lighting engineers.

The Great Business of the Babcock & Wilcox Boiler Company in the Electrical and other Industries.

A REVIEWITE seeking information relating to development in the electrical field met the well informed manager of the Babcock & Wilcox Company in this city recently, and learned that there were over 100,000 horse-power of Babcock & Wilcox boilers used in the electrical field in this country. Of course the lines in which this widely known boiler are used are the electric lighting and power branches. The rapid growth of electric street railways has had a great deal to do with the increased demand. Over 15½ per cent. of the very large business of this company now comes from the electrical field.

In the manufacture of sugar the Babcock & Wilcox Company have placed over 100,000 horse-power of boilers all along the line from the plantation to the refinery. In papers and printing the Babcock & Wilcox Company have some 22,000 horse-power. In textile manufacture 78,000 horse-power, and in blast furnaces and rolling mills of iron works some 110,000 horse-power.

A fact that is very gratifying to the Babcock & Wilcox people is the large percentage of repeated orders they have received since they started in business in 1868. The company was formed in 1881, and its records from that date are as follows:

Percentage of repeated orders in			1881, 36	per cent.
"	"	"	1882, 43	"
"	"	"	1883, 38	"
"	"	"	1884, 49	"
"	"	"	1885, 55	"
"	"	"	1886, 72	"
"	"	"	1887, 61	"
"	"	"	1888, 56	"
"	"	"	1889, 59	"
"	"	"	1890, 61	"
"	"	"	1891, 61	"

The sales made in 1891 were three times the amount in horse-power made in 1881, which is an increase in business that is certainly very satisfying. That nearly 16 per cent. of the very extensive business of this company now comes from the electrical industry, an industry which was unknown 10 years ago and which has made its biggest strides during the past five years, gives the public some idea of the wonderful advance that is being made in this comparatively new field.

Selective or Individual Signals.

ABSTRACT OF A PAPER READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, JUNE 6-8, 1892, BY THOMAS D. LOCKWOOD.

The business of the average user of the telephone keeps a line employed but for a very small part of the entire business day, and for the remainder of the time the line wire is idle and earning absolutely nothing. If by any means it could be made possible

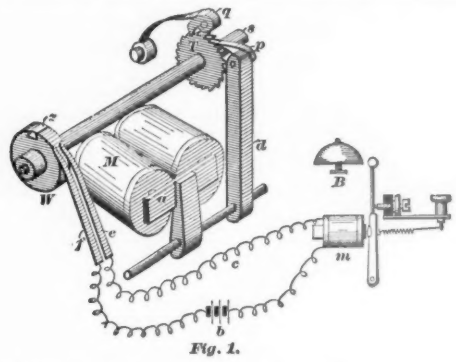


Fig. 1.

to place several sub-stations in connection with the same circuit, without materially affecting the efficiency of the service rendered, it is obvious that the earning power of the circuit would be largely increased. But a call-bell or other signal is clearly necessary, in order that the attention of the station may be attracted when some other station desires to communicate, and as we add stations to a circuit we also necessarily add call-bells, thus introducing most incessant and annoying ringing or the necessity of distinctive signals.

That two or more stations being electrically connected with the same circuit, the call-bell at any desired one may be operated, to the exclusion of the call-bells at the other stations, which at the same time remain quiescent.

The idea of producing a practical selective signal is not one which made its first appearance subsequent to the advent of the telephone. Appliances possessing the same characteristics appeared in England many years ago, and several forms have from time to time been patented in that country for use in connection with telegraphy, which closely resemble some of the forms which, within the last 10 or 12 years, have been re-

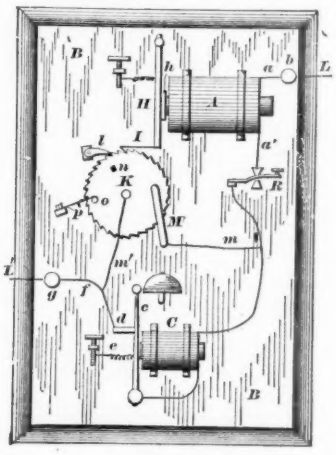


Fig. 2.

invented and patented here. One of these* is based upon combinations of a plurality of line wires, two or more of which extend from a terminal to each two sub-stations.

A second† involves two wires together with the use of both directions and varying strengths of current.

In France, too, in connection with railway telegraphy, this class of invention was formerly very popular and the late Count du Moncel devotes considerable space to the subject in the *Expose des Applications de L'Electricité*, Vol. III, 1874, pp. 510–528.

* Br. Patent 12,039, January 25, 1848, H. & E. Highton.

† Br. Patent 12,959, February 7, 1850, E. Highton.

The principles which govern printing telegraphy are closely related also to selective signaling. Consider, for example, the House, Hughes and Phelps telegraphs, and the form of stock quotation recorders now so universally employed; in all of these a given letter or figure is brought to a suitable point and is then pressed by a final operation against the paper to make the impression.

A good stock of knowledge thus was at the disposal of those interested, even at as early a date as 1876, when the career of the telephone was only beginning. We had the electro-magnetic ratchet and pawl, step-by-step, movement. We had electrically controlled clock-trains. It was old to trip clockwork electrically; and also to use wheel circuit changers. The unison device in connection with step-by-step devices was old, and its use well known; the relay and its function of closing local alarm circuits was already a classic; wire combinations of various sorts were customarily employed; and the harmonic field had already been well threshed by Helmholtz, Bizot, La Cour, Varley, Gray, Bell and others. Why, then, was it not easy to make at once a thoroughly satisfactory and efficient selective call?

One reason is that the average inventor, or would-be inventor, generally refuses, tacitly it is true, to recognize that there is any material of which he may make use. He does not know the state of the art; does not want to know the prior art; does not care anything about the prior art, and often feels affronted when he is necessarily brought face to face with it.

From January, 1879, to December, 1891, 161 United States patents were granted for forms of telephonic selective signaling appliances, all of which I have examined. A careful analysis shows that quite a large number of general plans have been proposed, and that each of these has been developed in several ways, with greater or less care and to many degrees of perfection.

There are various reasons why selective signaling has not come into general use. Some forms of promising selective apparatus have been put into use before being mechanically perfected, and their faultiness has given a figurative black eye to the entire race; some have been inherently defective, either in principle or construction; many, as soon as crudely devised, have been employed as beasts of burden on which to organize a heavily captalized stock company, and it has, therefore, been the great object of the advocates of these to sell stock instead of to make a practically successful apparatus. To be commercially successful, a selective signal for a telephone system must be of low cost, and in every form which has been put out and which has come under my observation, this requirement has been too prominently insisted upon, and the attempt has been made first of all to make not merely a low priced, but a really cheap signal; excellency has not been insisted upon; in many instances the apparatus has been required to do too much, or to perform too many functions, and has, therefore, become complicated; and usually the places where such signals have been tried have also been places where intelligent supervision has been at a minimum.

Under the above circumstances, good results need not have been expected; the user, after trying successively many of the different kinds of signals from time to time placed before him, has, with the few exceptions already noted, discarded all; and for a long time now has refused to listen further to the voice of the charmer, alleging, and with some show of reason, that "the only trustworthy individual signal is an individual line."

To aid the adventurer who intends to construct such an apparatus, I will outline the principles upon which this class of work, in its several proposed plans, have so far been founded, reference being made in brackets to a single U. S. patent exemplifying each of the several plans.

1. To operate the several signals at each sub-station on a circuit with differing strengths of current. Bells depending for their proper operation on a margin of current are, however, generally untrustworthy. (U. S. Patent No. 221,512, Nov. 11, 1879, Buell.)

2. Signals arranged to respond to currents of opposed direction. This implies, of course, polarized bells, and for a line with but two stations, it is probably as good an arrangement as can be provided. (U. S. Patent No. 218,153, August 5, 1879, Anders.)

3. Signals involving changes both in strength and direction of currents. These are apt to be unreliable for the same reason as are those of No. 1. (Patent No. 242,408, May 31, 1881, Anders and Vail.)

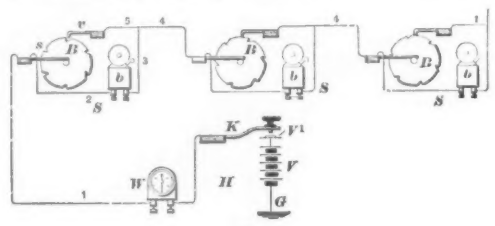


Fig. 3.

4. Electro-magnetic step-by-step devices, acting to bring the sub-station signals to a ringing point differing for each section, and then to close a local, branch or shunt circuit, including the local bell, to operate ringing mechanism, or in some way to introduce the bell magnet into the circuit. Fig. 1, taken from a patent of E. N. Dickerson, Jr., illustrates a ratchet and pawl step-by-step movement operating to close a local circuit in which is placed the bell. Successive pulsations sent from the central station cause the electro-magnet M in the main line circuit to attract its armature *a*, which after each pulsation is pulled back by a suitable spring (not shown). The non-conducting wheel *w*, on which presses the two springs *e* and *f*, has at one point on its periphery an inlaid piece of metal *z*. When the wheel is rotated till the plate *z* comes under the two springs, the local circuit of the battery *b* is closed through the bell magnet *m*, and the bell B, which in practice would be vibratory, rings. The wheel *w* can be adjusted on its shaft *s*, so as to be in a different position at each station, and is operated by the main magnet through its armature *a*, lever *d*, pawl *p*, and ratchet wheel *r*, the retaining pawl *q* holding the shaft *s* between the several forward impulses.

There are, of course, many other ways of utilizing these principles, one being shown in Fig. 2, which is one of the drawings of a patent taken out by Messrs. Curtis & Crocker. In it the main line L comes to the binding screw *b*, passes by the wire *a* to the main electro-magnet A, which acts through its armature *h*, lever H and pawl I on ratchet wheel K, held at any point by the retaining pawl *t*, and provided with a zero spring *p* and stop *o*. The ratchet wheels K are metal, and at a point on their disk surfaces, differing for each station, have a non-conducting piece *n* let in flush with the said surface. A contact spring M presses also on the conducting surface. After passing the magnet A, and continuing by wire a^1 to a key B, used to call the central station, the circuit divides, one branch passing through the magnet C of the call-bell, and thence by way of the bell hammer lever *c*, back contact *d* and point *f* to the terminal *q*, and thence to the outgoing line L^1. The second branch passes by wire *m* from the point of division to the contact spring M, thence to the ratchet wheel and through the mechanism and by the wire m^1 to the reuniting point *f*, binding screw *g* and outgoing line. Thus, as long as the contact spring M presses on the metal face of the ratchet wheel, the bell magnet is short-circuited; but when, as the wheel is revolved, the end of the spring presses on the non-conducting piece *n*, the shunt circuit is broken and the bell introduced and rung. This general plan No. 4 has been much favored by inventors, admits of almost indefinite variation, and is easily associated with auxiliary devices, such as unisons, busy signals and lockouts for apparatus at other stations. If mechanism properly designed and made be employed, there is no reason why satisfactory results might not be expected. Cheap apparatus has, however, invariably been tried, and the system, besides, is slow. (Patent No. 212,792, March 4, 1879, E. N. Dickerson, Jr.; Patent No. 230,530, July 27, 1880, Curtis and Crocker.)

5. Clockwork bells. (*a.*) Those in which a constantly running clock train brings the bells at the different stations into circuit successively, or removes a mechanical holder from their hammers; when only they can be rung. These are not reliable; it being impossible to keep the clocks together; the clocks also require too frequent winding. (Patent No. 223,469, January 13, 1880, Bliss.) (*b.*) Those in which at each station is a normally stopped clock-train. All clocks are started by the same initial pulsation, and bring their signals to ringing points, or their bells into circuit at different times.

This idea is one of the most practical that has been advanced, and if the apparatus is well designed and put together in a good mechanical form, it ought to do good work; unfortunately, first-class apparatus is costly enough to remove the gilt from the economical side of the selective signal. This plan is indicated by the diagram Fig. 3, in which, however, the clockwork is not shown. In the diagram, H is supposed to be the signal transmitting, and S the signal receiving station, at each of which is a metal circuit wheel B, by which, in conjunction with the circuit springs *s* and *v*, the bells *b* are, when at rest, short-circuited. At the transmittion station is a circuit closing key K, a battery V having one pole united to earth or return G, and the other extended to the front contact V^1 of the key, and a duplicate W, of the several sub-station instruments. The first pressure of the key through suitable mechanism starts the clockworks at all stations, and introduces the bells at each station successively, as the wheels B bring their notches under the springs *v*. The wheel are, in the present instance, supposed to be slow moving, and to have six ringing notches for each complete revolution. They can, by suitable mechanism, be stopped on each notch to ring a given bell as long as may be desired; and they come to rest after one notch at all stations has passed under its spring. Of course, the notches are arranged to pass under the springs at different times for the several stations, and this is indicated in the figure, where the bell at the nearest station is introduced into the circuit; the

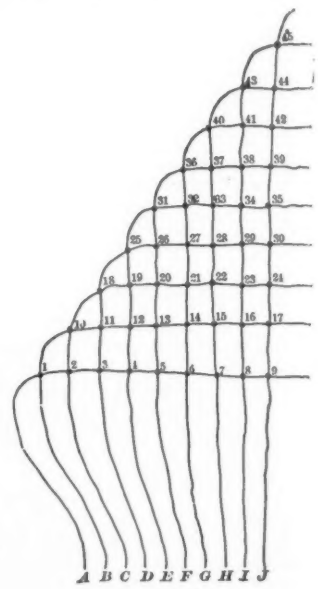


Fig. 4.

springs *v* of the others being at different positions on the periphery of the wheel. (Patent No. 232,442, Sept. 21, 1880, Blake.) (*c.*) Those in which a normally quiescent clock-train is controlled by an electro-magnetic escapement, and permitted to move by successive beats, as a key at the central station alternately makes and breaks the circuit. (Patent No. 228,047, May 25, 1880, Eaton.) This could doubtless be made to work all right by putting excellent apparatus into it, but, like nearly all step-by step devices, would generally be slow.

6. Bells in which all the hammers move forward to strike at the same time, but except the desired one are prevented from striking by an interposed mechanical obsta

cle, which in the bell of the wanted station is removed. This has been faithfully tried. It was operated by an electro-magnetic ratchet and pawl, and was uncertain in operation. It also developed another fault, viz., that even the bells which are not to respond make a considerable rattling. (Patent No. 219,059, Sept. 2, 1879, Anders.)

7. Bells in which the ringing is done by circuit arrangement or conductor combinations. Two series of circuits may radiate from a central to a number of sub-stations, and one of each series caused to enter all stations. No two stations, however, have the same two circuits. Only when the current traverses both circuits does the bell ring at the station they enter. This is very promising. It cannot, however, be applied to a multiple switchboard system. It requires relays and a local circuit bell, but no specially constructed apparatus. It is also very speedy, the single pressure of a given key will always ring a given bell, and no mistake can be made. This system is roughly illustrated by the diagram, Fig. 4, in which each outgoing conductor is shown to intersect each other conductor at some one sub-station, and thus afford facilities for producing a selective signal for 45 stations by using but 10 main lines. For example, if it be desired to signal Station 41, it will be necessary to manipulate the lines G and I. The diagram, Fig. 5, more fully illustrates one way in which the idea is worked out, although there are several plans, all of which are more or less advantageous. A battery B, branches its two poles to each of a series of keys k, each of which controls the terminals of two lines; for example, key k may control terminals of A and B, k^3 those of A and C, and so on. At each sub-station two lines both enter and pass, respectively, through relays, and the concurrent action of the two relays at any station is required to ring the bell, since the bell circuit is led through the armature levers and their front contacts of both. Taking the conductors in pairs, the number of possible combinations is represented by the expression $\frac{n^2 - n}{2}$ and that number of separate stations can be selectively signaled by the use of n wires. (Patent No. 219,188, Sept. 2, 1879, Vail; Patent No. 224,855, Feb. 24, 1880, Vail.)

8. Bells working on the principles of harmonic telegraphy. At each station the spring, pendulum or reed carrying the bell hammer is tuned to respond to a different note or rate of vibration. The central station transmitting device is adjustable, and can have its rate made to correspond with that of any sub-station bell. When set in operation the coinciding bell only will ring. Operated always by experts, and carefully constructed and adjusted, these might do well. They are, however, too sensitive; tend to become operative as their proper number of vibrations is approached, and in some degree become irregular with temperature changes. Fig. 6 illustrates the idea, and shows a central and three sub-stations. At the central station is a battery z, and three pendulum circuit-breakers formed into a single apparatus x^1. Each breaks and makes the circuit at a different rate of speed. The main circuit passes through the magnets A of the different sub-stations successively, each magnet having a reed armature, to which a pendulous bell hammer is attached, the normal rate of vibration thereof corresponding to that of some one of the transmitting circuit-breakers. At the end of the circuit is shown a second transmitter x^2,

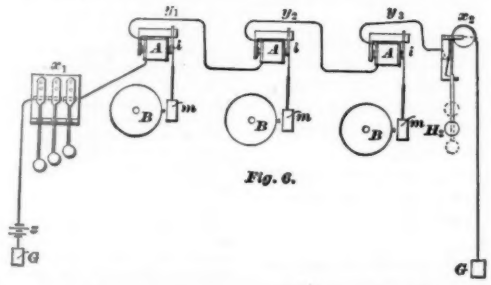


Fig. 6.

with which, if desired, the sub-stations may be provided. It has an adjustable pendulum bob n^3, which can be moved to correspond with that of any bell which it is desired to ring, and which, then being set in vibration, is responded to by such bell. (Patent No. 251,097, Dec. 20, 1881, Currier.)

9. Sub-station signals in which galvanometers, identically constructed and calibrated, make the same deflection with a given current; to ring the bells, different currents are sent, which produce different deflections. Each, of course, has its ringing deflection at a different point, which may, by a mercury cup, close a local circuit. These signals ought to work fairly well if sufficient care and cost be put into them. It would not be difficult to add several other classes to this list, but those which have been mentioned are the most important. (Patent No. 262,252, Aug. 8, 1882, Southworth.)

The plans of great promise are: Those which by clockwork (as in 5b) being brought to a ringing point differing for each, the clockwork being then stopped, and the ringing done by a different kind of current, and those which, as in Class 7, require the coaction of two circuits. Either of these when adopted should be worked in connection with a local battery. Probably in practice it will be found advantageous to have a separate circuit distinct from the telephone circuit, on which a great number of selective signals may be connected.

Many sub-methods and appliances have to be thought of in considering this subject; whether we will be content to ring sub-stations from the central station only, or, on the other hand, give each sub-station the power of signaling others on the same circuit. If step-by-step apparatus be employed to successively bring the station appliances

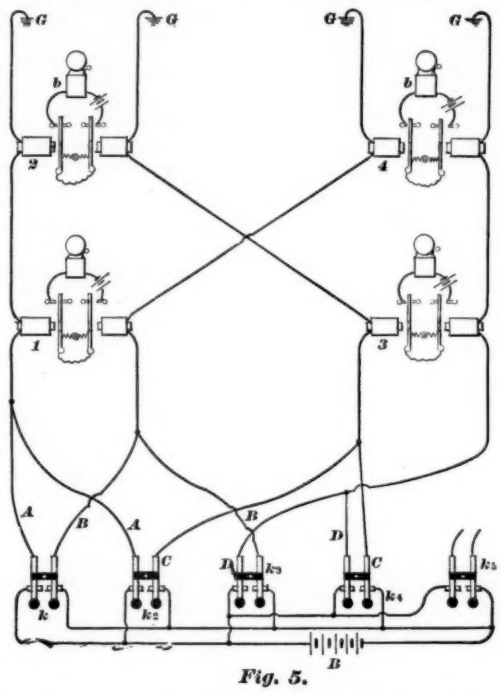


Fig. 5.

to their ringing points, some means is required to prevent the bells of intermediate stations from giving a signal as they are passed. Sometimes the time element may here be utilized. But a better way is to have the call-bell in a local circuit open at two points, to let the advance of the apparatus close one of these, and then send a different kind of current to close the other. We have to consider also whether the introduction of line-in-use signals, unison apparatus, call-sending appliances and telephone lockout apparatus are sufficiently important to be added.

The unison or zero device in some form may be considered as an essential auxiliary in all progressive signals, whether of the clockwork or step-by-step orders. Even the most perfect mechanism slips occasionally, and as in the stock printing systems, where instruments "throw out" or get out of step with each other, a suitable zero at which all can periodically be brought to rest, and start even, must be certainly required. A "busy" signal which indicates at each station whether the line is in use at any other is useful, but not essential. And lockout apparatus, usually provided by closing a shunt circuit round the call sending mechanism, and telephones, at all stations on a circuit, except the one or two which are actually communicating, is also highly advisable in order that privacy and freedom from interruption may be maintained. But, while some of these devices are necessary, and all useful if reliable, the contriver from this time forward must keep at all times before his eyes the undoubted fact that selective signals, where heretofore tried, have uniformly been handicapped by being too intimately associated with too many such auxiliary devices, and must be correspondingly cautious about the way in which they are added. Some such mode as is depicted in Fig. 7 is best for this purpose. In the figure, M is a clock-tripping magnet; F the magneto generator for sending outgoing calls, b the station bell, and m and n two metallic wheel commutators mounted on, and electrically connected with, the same shaft B. Arranged to press on the periphery of m is a contact spring v^1 and similarly placed with respect to n, is a spring v. When the station mechanism is at rest, it is desirable to have the generators in the line circuit, but the bells out. Accordingly, the bell if short-circuited through the disk n, spring v, and wires 14 and 5; while a possible shunt circuit round the generator through disk m, spring v^1, and wires 1 and 14 is open, the spring v^1 being over the notch. The notches of m are placed alike at all stations, but those of n differ at all stations; and, therefore, as soon as the shaft B begins to move, when the driving clock-train is tripped, the shunt circuit is established round all the station generators, and no station can interrupt by an attempt to send a call signal. Such a device is well enough, because it can generally be added without at all impeding the operation of the signal proper, and in any case constitutes a perfectly proper adjunct to the equipment of a party line. But when associated with selective signals the greatest care is necessary to provide that the arrangement is such that the auxiliary appliance may not prove a drag on the signaling mechanism.

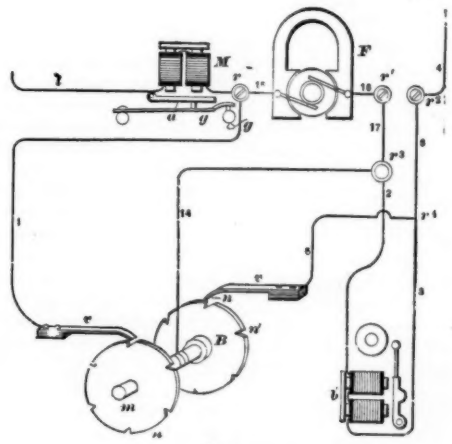


Fig. 7.

LITERARY.

"A Few Acts and Actors in the Tragedy of the Civil War," by William Bender Wilson, a military telegrapher in war times, is published by the author in Philadelphia.

Mr. Joe Kerr, editor of *The Club*, a bright and entertaining monthly publication, is the author of a book entitled "Joe Kerr's Jests, Jingles and Jottings," which will appear about August 1. The book will be beautifully illustrated, will contain many of the bright writings of Mr. Kerr and will undoubtedly receive a flattering welcome. Mr. Kerr's humor is of the refreshing kind that will make his book a particular delight in the hot weather.

The International Ore Separating Company.

TO THE EDITOR OF ELECTRICAL REVIEW:

We notice in your issue of June 4 an article stating that the Magnetic Separator Company owning the Ball-Norton patents have brought suit in the United States Courts for the district of New Jersey against the International Ore Separating Company, of No. 1 Broadway, charging the infringement of certain United States patents numbered 404,332 and 404,333. The article proceeds in a strain eulogistic of the Ball-Norton separator, and is evidently intended to advertise and increase the sale of such machine, and to frighten away customers dealing with the International Ore Separating Company.

We wish to say on behalf of the latter company that this statement that suit has been brought against it by the Magnetic Separator Company, or by any other person, firm or corporation, is unqualifiedly false.

The International Ore Separating Company operates under patents assigned to it, which infringe no other patents whatsoever, while eminent counsel have repeatedly advised that the claims of the patents of the Ball-Norton are invalid, and this the International Ore Separating Company stands ready to prove before any court of law or equity. By the actual practical results of separation, as well as by the opinion of those best qualified to judge, the separators built by the International Ore Separating Company are superior by reason of their simplicity, cheapness, durability and efficiency to all others now on the market.

The especial features of these separators are absolutely new—the spirally wound drums of small diameter, the special forms of magnet with consequent poles, the method of transference from drum to magnets, the combination with these of a belt and rollers, together with the method of operation under the surface of water, are all completely protected by United States and foreign patents, and any infringement of these will be promptly prosecuted.

INTERNATIONAL ORE SEPARATING CO.,
HARVEY S. CHASE, Treasurer.
New York, June 8, 1892.

Association of Railway Superintendents of Telegraph.

The Association of Railway Superintendents of Telegraph will hold its annual meeting at Denver, Colo., June 15. The Santa Fe route will run a special vestibuled train for the delegates from Chicago to Denver.

The Faure Patent in Germany.

The Supreme Court of Appeal at Leipsic has delivered a judgment confirming the decision of the patent office at Berlin and establishing the validity of the Faure patent. Several of the secondary battery manufacturers in Germany had entered process in the patent office, seeking to have the Faure patent declared invalid on the ground that its main features had been anticipated. This contention has now been finally disposed of in favor of the Faure patent. This decision will have an important effect on the secondary battery business in Germany.

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CONTENTS.

	PAGE.
Views, News and Interviews	213
An Electric Light Bath	213
Electric Railway at Oskaloosa	213
New England Electric Club	213
Telephonic Underground Construction in the Northwest	213
Want the Trolley in New York	214
Electro-Medication	214
Changing the Badge	214
The World's Fair Incandescent Lighting Contract	214
Women Decide Against Electric Lights	214
Of Interest to Electrical Exhibitors at the World's Fair	215
A New Cable	215
An Electric Club for Manchester	215
The Electric Sugar Frauds	215
Electric Launches for the World's Fair	215
American Society of Civil Engineers	215
Electricity and Fires in England	215
The Great Business of the Babcock & Wilcox Boiler Company in the Electrical and Other Industries	215
Selective or Individual Signals	216
Literary	217
The International Ore Separating Company	217
Association of Railway Superintendents of Telegraph	217
The Faure Patent in Germany	217
Switchboards	218
The Teacher Taught	218
Correspondence:	
Our Seattle Letter	219
Our Three Rivers Letter	219
Our Chicago Letter	219
Personal	219
The American Institute of Electrical Engineers	219
About That Hole	219
Telephonic News	220
A New Flush Switch	220
A New System of Electric Propulsion	220
Telegraphic	221
Telephone Receivers at the Crystal Palace Exhibition	221
Electric Power	222
Electricity and the Law	222
Edison Electrical Controlling Table for Street Railway Stations	222
Flash-Lights for Mars	222
Obituary	222
Train Lighting	223
Lighting Combination at Kansas City	223
The Electric Light on Battlefields	223
An English Train-Lighting Dynamo	223
Electric Light News	223
Kindred Interests	224
Electrical Patents	xii
New Incorporations	xii

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
American Electrical Works	i
Ansonia Brass & Copper Co	xx
Armington & Sims	xx
Baker & Co	xx
Beacon Vacuum Pump and Electric Co	i
Bridgeport Brass Co	xx
Brush Electric Co	xix
"C. & C." Electric Motor Co	ii & xix
Crocker-Wheeler Motor Co	i
Day's Kerite	xx
Dixon Crucible Co	xx
Eastern Electric Cable Co	xx
Eddy Electric Mfg. Co	i
Hampson & Co., E. P	xx
Jewell Belting Co	xx
Link Belt Engineering Co	i
Moore, Alfred F	xx
Noye Mfg. Co., John T	xx
Okonite Co	i & xx
Otis Bros & Co	xx
Perkins Electric Lamp Co	i
Schuyler Electric Co	xix
Simplex Electrical Co	i
Solar Carbon & Mfg. Co	xx
Star Electrix Co	i
Wainwright Mfg. Co	i
Waterhouse Bros	i
Weston Engine Co	i
Wilmot & Hobbs Mfg. Co	xx

INSIDE PAGES.

Allentown Foundry & Machine Co	xiii
Allis & Co., Edward P	x
American Bell Telephone Co	xvii
American Casualty Insurance and Security Co	xi
American Engine Co	xi
Arbuckle, F. P	224
Ball Engine Co	xii
Barnes Co., W. F. & John	xii
Barrett, John A	xii
Benedict & Burnham Mfg. Co	iii
Bernstein Electric Co	xv
Bickford & Francis Belting Co	xi
Bishop Gutta Percha Co	xi
Brill Co., J. G	xvii
Buckeye Engine Co	xvii
Burton Electric Co	viii
Central Electric Co	ix
Century Co	viii
Chester Steel Castings Co	xv
Church & Sleight	xvii
Conover Mfg. Co	xv
Cutter Electrical & Mfg. Co	x
Day's Kerite	xviii
Detroit Electrical Works	x
Dwight Slate Machine Co	xv
Edison General Electric Co	vii
Electrical Progress	224
Electric Secret Service Co	xviii
Electro-Light Engraving Co	xiii
Empire China Works	xvii
Eureka Tempered Copper Co	viii
Evans Friction Cone Co	x
Faraday Carbon Co	xvii
Falls Rivet & Machine Co	xiii
Fitzgerald, S. G	xii
Fletcher & Fletcher Electric Co	xvii
Garvin Machine Co	xiii
Graves Electrical & Mfg. Co	221
Greeley & Co., The E. S	xiii
Harrisburg Foundry & Machine Works	xii
Heisler Electric Co	iv
Holmes, Booth & Haydens	iii
Independent Bung Co	xiii
Johns Mfg. Co., H. W	viii
Kellogg Iron Works	v
Klipstein, A	xvii
Law Battery Co	224
Leclanche Battery Co	xi
Leffel & Co	viii
Lehigh Valley Creosoting Co	xi
Leonard & Co., H. Ward	xvii
MacKie, Robb	224
Marshall, Wm	vi
Merchant & Co	vi
New England Butt Co	xv
Newton Rubber Co	x
New York & Ohio Co	xv
New York Belting and Packing Co	xvii
New York Insulated Wire Co	vi
Onondaga Dynamo Co	vi
Ostrander & Co., W. R	xvii
Penn Life Co	224
Phœnix Glass Co	vi
Phosphor Bronze Smelting Co	xiii
Prentiss Tool & Supply Co	224
Queen & Co	x
Railway Equipment Co	iv
Ries Electric Specialty Co	vi
Ridlon & Co., Frank	xii
Rosenbaum, Wm. A	xii
Rose Polytechnic Institute	xii
Royce & Marean	xvii
Roy Valve Co	iii
Sawyer-Man Electric Co	ix
Seely, John A	xviii
Shawmut Fuse Wire Co	xiii
Shipman Engine Co	xv
Short Electric Railway Co	x
Standard Electric Time Co	224
Stanley Electric Mfg. Co	xi
Stevens & Morris	vi
Stocking, E. B	xii
Thomson-Houston Electric Co	vii
Time Electric Co	224
Tyndall, Wm. D	xii
Waddell-Entz Electric Co	vi
Walworth Mfg. Co	iii
Washburn & Moen Mfg. Co	xii
Watson & Stillman	xiii
Western Electric Co	xiii
Westinghouse Electric & Mfg. Co	iv
Wheeler Condenser & Engineering Co	viii
Willson, H. B	xii
Wood, Jr., John	xv

We doubt not that our political friends have much enjoyed the splendid rapid transit facilities afforded by the very complete electric railway system of Minneapolis.

Under a new law in New York State, town boards are authorized to establish lighting districts outside of incorporated villages, and to make contracts for a period of not more than three years. Contracts can be made upon petition of not less than 25 taxable inhabitants of the district to be lighted, or a majority of the taxpayers thereof, which must be filed with the town board 30 days before the contract is made, and proper notice given by publication or posting. The expense of the lighting is laid upon the taxable property within the district to be lighted.

In selecting the site for an electric light or power station, one very important factor of value is often neglected. At the same time that the engineering questions in reference to a location are considered, due thought should be given to the real estate value of the site in view. Some very fortunate investments have followed such consideration. In one case an electric light company bought more land than it would ever need, because it was in a desirable location and could be purchased at a fair price. The company has all the room it needs for its plant and is now erecting dwelling houses on the vacant portion of its land. Moreover, such an increase in land values is possible that it would pay a company to sell out its real estate and rebuild its plant in another place, often a great advantage in itself.

In this issue will be found a very interesting article on "Telephonic Underground Construction in the Northwest," by Mr. C. P. Wainman, general superintendent of the Northwestern Telephone Exchange Company. Some exceedingly novel underground work is described. The distributing boxes, cable boxes, and other devices mentioned, have been designed by Mr. Wainman and Mr. P. G. Reynolds, superintendent of construction for the Northwestern company. The tunnel work mentioned is especially unique.

SWITCHBOARDS.

The advances recently made in the art of electric light and power switchboard building are most gratifying. Not long ago it was customary to see this most important piece of apparatus constructed of scantlings, covered with light wood sheathing, forming a constant menace to the safety of the plant which it controlled. Nowadays we see handsome and artistic combinations of iron, brass, slate and marble taking the place of the old flimsy structures. Great advances have also been made in reducing the size of switchboards, as well as in making them fireproof.

But why should a switchboard be built as a plane surface? Why not curl it up so that a ground plan would look like the letter C? The opening would be for ingress or egress. Construct the board in skeleton form, so that openings would be afforded for the attendant to watch the machines and you have a compact device within the control of one man, who can at the same time see all that is going on in the dynamo room. There would be no long jumps or stretches from one switch to another, and in case of an emergency every important instrument would be found concentrated at one point.

The progress made in this matter is eminently satisfactory and is due in a great measure, probably, to the intelligent work of insurance inspectors and to the good sense and desire to do better of the switchboard designers.

THE TEACHER TAUGHT.

The position of an instructor is always an honorable calling, that is, in the eyes of the teacher. With the pupil it depends upon circumstances, especially if his school days are over.

It was only a short time ago; to be precise, the first of month before last, a day which some folks celebrate, that a friend remarked that, wise as we were, he knew something which we didn't know. Such a challenge could not pass unnoticed, and rejoinder was at once made that the statement would be accepted for the sake of argument if a disclosure was made as to the nature of the gap in our cyclopædic intellect. The reply was at once made that there was a sign "To let" in our hat-band, something which he knew, but we didn't.

Again, we have received instruction from one who has proffered a sample of principles unknown; and the communication contains so much of friendly warning that we pass it along for what it is worth, allowing the recipients to keep the change.

The communication contained a note for $100, payable in 90 days, as a guarantee of good faith, rather than the evidence of any financial solidarity.

By way of apology it should be said that the note became lost in the waste basket, and in any event, certain technical matters prevented the affixing of our autograph on the back as a preliminary to its conversion into the funds of the realm.

The funds which we were to send were to be placed in immediate circulation, not in any ignoble use in paying butchers' bills or settling grocers' accounts, but for the purpose of making a pilgrimage to Washington and submitting to President Harrison and Secretary Blaine (our correspondent overlooked the resignation) the "polaristic battery" with the "polar adjunct." These terrible phrases do not refer to any subtle weapons of anarchists; but to a powerful agency, which will contravene the schemes of such conspirators.

Hear him: "With this single instrument I can prove that in a city having gas and water pipes, they make connection with the dynamos spherical polar creation of light which surrounds their wires; and the polar sphere cannot be created without the contrapose force from fire in air which must surround the positive and negative polar creation of a dynamo or the polar battery. It is this law that causes the metallics connected to set fire at positive and negative polar centers by the contrapose atmosphere in buildings.

"Where there is electricity there is ether, and it fills all space around electric wires, and there is even more of it around electric lights.

"Induction is still worse, ordinary insulation cannot hold it. The rule is, The better the insulation the greater the induction. Now, my insulation will kill the worst case of induction ever known. If applied to a telephone, the central station girl will hear your ring at once and answer back p. d. q."

(We fear there is a swear word concealed in this, but give our correspondent the benefit of the doubt.)

"Our country is permeated with conspirators who, with a knowledge of this grounded polar creation, subject as it is to the polygonal angles of the globe, could sack all cities where it exists."

It is evident that if this "polar creation" exists wherever there are gas and water pipes, and that conspirators know it and are going to touch it off, that, like the advice in the colored elder's sermon on the "broad and narrow way," the only refuge lies in taking to the woods.

But, seriously, this case is not without frequent precedent, and probably our correspondent, like others who have partially developed ideas in regard to electricity, has not failed to enlist the confidence and financial support of others who have not acquired the technical knowledge or practical experience to perceive the errors in statement, and the misuse or even the fabrication of scientific terms.

Investors, however, are correct in their general estimate of the value of electrical enterprise. Every one knows of the fortunes made by Morse and his associates in the development of the telegraph into a part of commercial existence; of those made by Bell and his associates in the exploitation of the telephone into a daily necessity; of the just rewards of the work of Edison, Thomson, Brush and their various colleagues, modern Joshuas, who have lengthened the day, and it is not an expression of opinion, but merely a collocation of well-established facts, that the rewards of useful invention in electrical fields are sure and liberal.

However, there are inventors and inventors.

A patent is not synonymous with useful invention, nor does it on general terms represent a fortune.

It is comparable with what the late Senator Zach. Chandler once said to the writer, relative to the bills of the old State Banks in *ante bellum* days. Every business man used a bank-note detector, and that must be consulted, when an unknown bill was presented, to determine, first, whether there ever was such a bank; second, whether the bank was solvent, and, third, whether the bill was a counterfeit, although the latter could be generally identified by the superior excellence of its engraving.

Similar queries could be germanely made in regard to every patent, and any article which truly conforms to the legal phrase of being new, useful and original could hardly fail, under ordinarily good commercial management, to be also profitable.

Shakespeare's saphorism of "All the world's a stage," applies to the love of novelties in every-day affairs as well as novelties on the boards where the mimic of life is represented.

Returning to the text furnished by the letter from our inventive friend. It should be remembered that while the ordinary affairs of an uneventful life may form the most complete training for an invention involving mechanical construction, yet a proper grasp of the principles and application of electricity is not of such general possession and cannot be acquired in a short time.

It may be that our correspondent has made useful inventions in other departments of mechanical work, but it is evident that his assumed knowledge of electrical affairs is a pretense and a sham.

One cannot invent in electrical fields any more than in any other industry unless he knows what he is to improve upon.

It is for this reason that the graduates of technical schools are in possession of opportunities of peculiar value if these opportunities are only rightfully applied in connection with the acquirement of the proper practical knowledge which is essential to the full development of science in its application to the needs of every-day life.

CORRESPONDENCE.

OUR SEATTLE LETTER.

Fairhaven's Electric Road is now in successful operation.

The Lynden Electric Railway Motor Company has been incorporated with a capital of $250,000.

The Pullman Electric Light and Power Company has been incorporated with a capital of $25,000.

Frederick Ledyard has secured a verdict for $2,500 against the West Street and North End Electric Road, of Seattle, for personal damages.

John P. Fay, R. Hilton and Herman Chapin have applied for a franchise for an electric railway through the northern part of this city. Their plan is to construct the line 30 miles north to Everett.

Peder Pederson, who sued the Consolidated Street Railway Company for $10,000 damages, has obtained a verdict for $2,000. He was thrown from one of the cars on June 16, 1891, and quite seriously injured.

The Handsomest Electric Cars ever brought to the coast are run on the Fremont and Woodland Park line in the suburbs of this city. They have seats arranged like those of the regular steam car, and they are fitted with 50 horse-power motors.

The Lines of the Consolidated Street Railway Company have been insured with the Casualty Insurance and Security Company, of Baltimore, to the amount of $100,000, against all liability on account of loss or damage to persons, animals and merchandise.

L. W. Storror, superintendent of the Pacific Postal Telegraph Company, has recently been in this city. He said that the company would soon begin the erection of a line eastward from California to Colorado, which will be 1,200 miles long and will cost $350,000. This new line will give the Pacific Postal Company another outlet for its Eastern business and for competition with other companies.

The Tacoma Railway and Motor Company has purchased the Tacoma and Steilacoom line, thus increasing its trackage to 40 miles. By contract with the Northwest Thomson-Houston Company, the Tacoma Company has floated bonds which cancel the pre existing mortgage, cover the cost of the new purchase, and form a mortgage on the consolidated system. The company will also supply the Point Defiance, Tacoma and Edison Company with power for its lines.

The Edison General Electric Company has brought suit in the United States court to recover an alleged debt of $51,174.18 from the Port Townsend Belt Railway Company. The plaintiff claims that this amount is due on a contract for equipping the line, and that of the total cost only $4,000 has yet been paid. The debt is covered by promissory notes, endorsed by Julius S. Potter, C. B. Holman and H. C. Colver, who are made parties defendant. The court is asked to appoint a receiver.

L. H. Griffith, president of the Consolidated Street Railway Company, said a few days ago to the correspondent of the ELECTRICAL REVIEW: "I have been examining the reports of electric roads in other parts of the country, and I find that, considering the number of our cars, our operating expenses are just about the same as in Eastern cities. Labor of all kinds is higher in Seattle, and that item is, of course, larger, but we make up on the fuel. We burn sawdust, which costs practically nothing but the expense of handling."

At the Annual Meeting of the Union Electric Company the following officers were elected: President, E. C. Kilbourne; vice-president, J. M. Frink; treasurer, C. P. Stone; secretary, J. F. Robinson; trustees, John H. McGraw, Isaac Dobson, Angus McIntosh, C. P. Stone, J. A. McWilliams, J. M. Frink and E. C. Kilbourne. The Union Electric Company will soon have two 12½ horse-power electric generators to run small motors throughout the city. A number of extensions are being made for its street lighting system.

The Rainier Power and Railway Company, of Seattle, has let the contract for its equipment. The Short system of motors will be used, and the St. Louis Car Company will build the six cars. The present lighting plant will be increased by 2,000 incandescents and 100 arcs. The National alternating, or long distance, system will supply the former and the Western electric arc system has been adopted for the latter. This will be the first appearance of these electric systems in this State, except at Spokane, where the Short is used. A 300 horse-power Ideal steam plant will also be put in at the power station, as well as two 80 horse-power National railway generators.

The Sunset Telephone and Telegraph Company has begun operating its new copper wire line between this city and Tacoma. There is no ground connection, but a double copper wire is used for the circuit. The company is buying a large quantity of poles on Puget Sound for its extensions in California. Four schooner loads have already gone and several more cargoes are to go. An order has been granted temporarily restraining the telephone company from setting up poles and stretching wires along the line of the right-of-way of the Columbia and Puget Sound Railroad Company. The railway company alleges that the telephone company is interfering with the operation of the road.

The General Electric Company, which has considerable money invested in the electric roads which it has equipped in this city, has practically closed a deal for consolidating all the electric lines under one management. The companies which will come into the combine are the Seattle Consolidated, the West Street and North End, the Rainier Power and Railway, the Grant Street Electric, the Union Trunk, the Rainier Avenue Electric, and perhaps the Front Street Cable, which runs parallel to the electric railway systems of the city. The details of the plan have not yet been settled, though H. M. Byllesby, president of the Northwest Thomson-Houston Company, and Winthrop Coffin, from the Boston office of the General Electric, have been looking over the ground.

Seattle, Wash., June 4. H. L.

OUR THREE RIVERS LETTER.

M. Alex. Baptiste, is talking of putting in two dynamos, of 250 lights each, for his sawmills, one at Calumet and one on his island here.

The "Trifluvien," a local paper of this city, had an article in its last number about an accident that happened to the engine running the arc dynamo, and expected that we would have to depend on the light of the moon for over one month. So the people were very much disappointed to see the streets lighted Sunday night. It took six days to repair the engine. The *Trifluvien* did not prophesy right this time.

In the Suit of the Royal Electric Light Company, of Montreal, against the corporation of the city of Three Rivers, Judge Bunglois has referred the case to be decided by experts. He has appointed M. Bany, millwright of Morrisburg, and M. James Hereden, of Sorel, government inspector of dredges on the St. Lawrence river, experts. These gentlemen are very good, competent men in their line of business, but I should think that electrical engineers would have been the right men in the right place.

G. L.

Three Rivers, Canada, East, June 10.

PERSONAL.

Mr. G. B. Lauder, of the Consolidated Electric Company, Denver, was in New York last week for a few hours.

Among last week's New York visitors from out of town were Messrs. C. R. Huntley, of Buffalo, and A. J. De Camp, of Philadelphia.

Mr. J. C. Wilson, of the Automatic Time Stamp and Register Company, of Boston, was a New York visitor last week, looking after the interests of his company.

Mr. J. D Bishop, recently with Messrs. John A. Roebling's Sons Company, as electrical expert, has joined the staff of the Safety Insulated Wire Company, of New York.

The vacancy caused by the death of Mr. Chas. A. Scott, of the Union Switch and Signal Company, has been filled by the appointment of Mr. J. V. Young as agent and electrician in Boston. His office is at 620 Atlantic avenue, Hathaway building.

Mr. W. S. Hine will resign his position as general manager of the New York office of the Westinghouse Electric and Manufacturing Company and go upon the stage as an operatic star. Mr. Hine has one of the finest tenor voices in New York, and has been a member of the choir of the famous Dr. Parkhurst's church for several years, besides possessing a considerable reputation as an amateur actor. Mr. Hine will begin his professional work about August 1, and along in September the company, which will be under the management of J. M. Hill, will go out on the road to "try it on the dog," returning to New York about the middle of November. The opera will be a new one called "The Fencing Master," by Reginald de Koven, the composer of tuneful "Robin Hood." Mr. Hine is to have the leading tenor part, and Marie Tempest will assume the leading soprano role. The best wishes of his many friends, including the REVIEW, go with Mr. Hine in his new venture.

The American Institute of Electrical Engineers

HOLDS ITS ANNUAL MEETING AT CHICAGO—LARGE ATTENDANCE—INTERESTING PAPERS.

The ninth general meeting of the American Institute of Electrical Engineers was held at Chicago, June 6, 7 and 8, with headquarters at the Grand Pacific Hotel, and was attended by prominent electrical engineers from all parts of the country.

The meeting was called to order Monday at 10.45 A. M., by President Frank J. Sprague, and the following papers were presented:

1. "Experiments on Alternating Currents," by Dr. Louis Duncan, of Johns Hopkins University. 2. "The Relation between the Electromotive Force of a Standard Clark Cell and the Density of the Zinc Sulphate Solution," by Prof. H. S. Carhart, of the University of Michigan, Ann Arbor, Mich.

At 12.30 the meeting adjourned and the afternoon was spent in visiting the works of the Pullman Car Company, at Pullman, Ill., and much interest was manifested by the members in making the tour through the various departments. In the evening, upon invitation of the Chicago Electric Club, the Institute members met at the new quarters of the Electric Club and took part in the formal opening of the rooms. B. E. Sunny, president of the Club, presided at the meeting and introduced Lieut. Frank J. Sprague, the newly elected president of the Institute, who delivered his inaugural address. The management had prepared a lunch for the occasion, and after the meeting the members and guests passed the evening in exchanging views.

Tuesday the following papers were presented at the morning, afternoon and evening sessions, which were largely attended. 1. "The Magnetic Permeability of Special Irons for Electrical Purposes," by Messrs. Milton E. Thompson, P. H. Knight and Geo. W. Bacon, of Cornell University, Ithaca, N. Y. 2. Notes on Wiping Contact Methods for Current and Potential Measurement," by Prof. B. F. Thomas, of the Ohio State University, Columbus, Ohio. 3. "A Life and Efficacy Test of Incandescent Lamps," by Prof. B. F. Thomas and Messrs. P. Martin and R. H. Hassler, of the Ohio State University, Columbus, Ohio. 4. "Electric Coal Mining Machinery," by Mr. Elmer A. Sperry, of Chicago. 5. "Railway Train Lighting," by Mr. A. H. Bauer, of Chicago. 6. "Long Distance Transmission for Lighting and Power," by Mr. Chas. F. Scott, of Pittsburgh, Pa. 7. "Selective or Individual Signals," by Mr. Thos. D. Lockwood, of Boston, Mass. 8. "The Electric Percussion Drill in Theory and Practice," by Mr. Henry R. Marvin, Schenectady, N. Y. 9. "Electro-Technical Education," by Prof. R. B. Owens, of the University of Nebraska, Lincoln, Neb. 10. "A New Form of Resistance," by Mr. C. E. Carpenter, of St. Paul, Minn.

Wednesday morning papers were presented as follows: 1. "Series Electric Traction," by Mr. Nelson W. Perry, of New York City. 2. "A New System of Electric Propulsion," by Mr. H. Ward Leonard, of New York City. 3. "Oil *vs.* Air as Insulation," by Dr. J. B. Williams, of New York City.

The afternoon was spent in a visit to the World's Fair Grounds, under the supervision of Secretary Hornsby, of the Department of Electricity. A special train was secured for the occasion and the grounds were visited by over 100 members and guests, including many ladies. Much interest was manifested by all present and a very pleasant afternoon was spent viewing the wonderful progress which has been made on the various buildings and grounds.

The following members and guests were in attendance during the meeting:

Ralph W. Pope, New York, N. Y.; Carl Hering, Philadelphia, Pa.; Geo. M. Phelps, New York, N. Y.; H. S. Carhart, Ann Arbor, Mich.; A. de Khotinsky, Boston, Mass.; C. L. Cornell, New York, N. Y.; Chas. F. Scott, Pittsburgh, Pa.; R. J. Miller, Clinton, Ia.; C. Wellman Parks, Troy, N. Y.; M. J. Sullivan, E. F. Seixas and J. L. Barclay, Chicago, Ill.; Chas. E. Emery, J. B. Williams and T. J. Smith, New York, N. Y.; Wm. M. Porter, Detroit Mich.; C. R. Gilman, Milwaukee, Wis.; Clement F. Street, Chicago, Ill.; Edw. Caldwell, New York, N. Y.; C. C. Haskins, Chicago, Ill.; C. M. Sames, Rockford, Ill.; Alfred H. Cowles, Cleveland, Ohio; Edw. M. Highlands, Clinton, Ia.; A. F. Opperman and L. V. Lindon, Hornellsville, N. Y.; Geo. D. Shepardson, Minneapolis, Minn.; John H. Gregg, Chicago, Ill.; John R. H. Staley, Joliet, Ill.; J. F. Connor, Chicago, Ill.; H. Ward Leonard, New York, N. Y.; F. B. Badt and S. D. Flood, Chicago, Ill.; P. P. Beals, Buffalo, N. Y.; W. F. Collins, Chicago, Ill.; Percy Martin, Columbus, Ohio; W. B. Cleveland, Cleveland, Ohio; Chas. S. Bradley, Avon, N. Y.; D. C. Jackson, Madison, Wis.; Frank B. Rae, Detroit, Mich.; R. B. Owens, Lincoln, Neb.; Francis B. Crocker, New York, N. Y.; J. W. McCrosky, Pittsburgh, Pa.; Francis R. Upton, Orange, N. J.; Thos. D. Lockwood, Boston, Mass.; M. B. Speir and J. J. O'Connell, Chicago, Ill.; F. S. Hunting and A. L. Hadley, Fort Wayne, Ind.; John W. Howell, Newark, N. J.; Leo. Daft, Seattle, Wash.; W. A. Cathren, E. M. Barton, Charles A. Brown, M. J. Bulkley, William D. Ray, W. N. Smith, Chicago, Ill.; S. S. Bogart, New York, N. Y.; Benjamin F. Thomas, Columbus, O.; M. O'Dea, Notre Dame, Ind.; Robert S. Hitt, Elmer A. Sperry, Chicago, Ill.; Frank C. Perkins, Dunkirk, N. Y.; Harry N. Marvin, Schenectady, N. Y.; M. A. Edson, Carl K. MacFadden, James Kettlestings, Chicago, Ill.; F. P. Mills, Ishpeming, Mich.; Edward L. Nichols, Ithaca, N. Y.; T. C. Martin, New York, N. Y.; E. P. Roberts, Cleveland, O.; E. G. Willyoung, Philadelphia, Pa.; George Cutter, E. A. Merrill, Chicago, Ill.; Charles F. Dunbar, Pittsfield, Mass.; Nelson W. Perry, New York, N. Y.; Edward P. Burch, M. S. Howard, Minneapolis, Minn.; L. L. Summers, Fred. De Land, Chicago, Ill.; Frank J. Sprague, Herbert Laws Webb, Charles D. Shain, New York, N. Y.; George R. Mart, Boston, Mass.; A. F. Parks, Troy, N. Y.; O. E. Winger, Freeport, Ill.; E. P. Farwell, Chicago, Ill.

About That Hole.

TO THE EDITOR OF ELECTRICAL REVIEW:

I was much amused by the very facetious editorial in the issue of the REVIEW, under date of June 4, regarding the reception of a well ventilated copy of the Richmond *Times*, of May 15. I suppose you were so wholly unprepared for such a *transparent* joke that you could not refrain from ejaculating Holy Moses! when you saw through it. The *hole*, I mean, not the *joke*. The joke, however, was *wholly* unintentional and is chargeable to the unaccountable perversity of the average "sweet girl stenographer," to one of whom was delegated the duty of posting several marked copies of the aforementioned journal to as many different addresses, and cutting out of *one* copy the article indicated and pasting it in a scrapbook. The latter duty, I infer, must have been performed first, and then the mutilated copy must have become mixed up with the unmutilated copies, as Little Buttercup mixed up the Captain and Ralph, and as it chanced, *you* got it. How could she ever do it?

I, however, make the *amende honorable* by furnishing you with another copy of the *Times*, that has really been *marked* instead of *punched*, and beg to add that the removal of our operating-room to the new building, was successfully accomplished on the evening of Saturday, May 14, at 7 o'clock, without a hitch or a moment's interruption to the service. Yours hastily, but cordially,

C. E. MCCLUER, Superintendent,
Southern Bell Telephone Co.

Richmond, Va., June 8, 1892.

OUR CHICAGO LETTER.

Four Electric stamping machines, with a capacity for stamping 28,000 letters per hour, were received at the post office this week from Washington and will be put into service at once.

The Enterprise Electric Company have secured the agency for several very desirable specialties recently, and are rapidly increasing their stock, so that their store now presents a nice appearance.

R. J. Randolph, western agent Duplex Electric Company, of Corry, Pa., reports many orders received recently and that this company is rapidly building up a good business throughout the West.

W. R. Mason, general manager of the Railway Equipment Company, reports a great increase in business during the last month. Many large orders having been received throughout the East and South.

W. H. McKinlock, president of the Central Electric Company, returned to the city Thursday morning, after a week's visit in New York. Mr. McKinlock reports having secured some new specialties, together with a fan motor, which will be placed upon the market at once.

The American Institute of Electrical Engineers left the city Wednesday night for their various homes, and praise in loud terms the manner in which they were entertained while in the city. The Illinois Central Railroad kindly furnished transportation when desired, and the attention shown them by Chief Barrett, Chief Burnham, Secretary Hornsby and others was much appreciated by the members present. M. J. B.

Chicago, June 11.

Telephonic News

*** A telephone line is to be built between St. Marcos and Blanco, Tex.

*** Long distance telephone lines are being erected between Corry, Jamestown and Erie, Pa.

*** The Batesville, Ark., Telephone Company has declared a dividend of four per cent. for the last six months.

*** The telephone inspectors of the New England Telephone and Telegraph Company will hereafter appear in uniform.

*** The long distance testing station of the American Telephone and Telegraph Company, at Onondaga Valley, N. Y., was burned last week. Loss about $2,000.

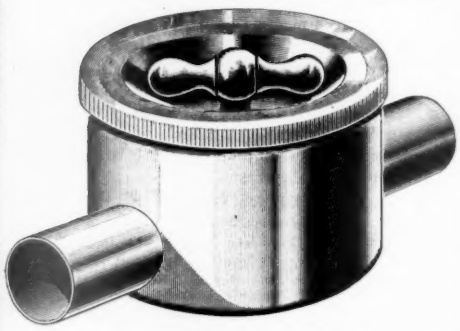
*** The telephone law enacted by the last Maryland legislature went into effect on June 1. It provides for a uniform rental rate of $78 an instrument per annum, within a radius of two miles from the central exchange.

*** Montgomery & Talcott have put in a long distance telephone which is a dandy. The editor tried it with one of Dunkirk's pretty hello girls the other evening, and, to put it mildly, we could almost hear her heart go pit-a-pat.—*Silver Creek, N. Y., Gazette.*

*** The $12,000,000 suit of the Western Union Telegraph Company against the American Bell Telephone Company was dropped at Boston, June 2; but in such a way that it can be re opened at any time. The suit was brought to compel the defendant to transfer to the plaintiff one-fifth of the shares of the capital stock of numerous corporations operating telephones and exchanges throughout the United States, and also one-fifth of the dividends of the companies and one-fifth of the sums paid the defendants for license to connect telephone exchanges, and one-fifth of the bonds and securities received for the licenses for telephones.

A New Flush Switch.

The new ten ampere flush switch, illustrated herewith, is manufactured by the Interior Conduit and Insulation Company, of New York, at the suggestion of a prominent architect, and is a production which has received high endorsement and commendation from the electrical trade. The accompanying illustration shows the many desirable features of the article. A notched cover is indented so as to allow the handle of the switch to be flush with the wall on which it is placed, and a brass rim extends



A New Flush Switch.

around the edge so as to protect the wall from soiled hands when unscrewing the cover, and at the same time serving to impart a finish to the switch when placed in position. The advantages of this switch are at once apparent, and the article instantly commends itself to the attention of architects and others interested in rendering the various appliances used in conjunction with incandescent electric lighting ornamental and unobtrusive, as well as useful.

A New System of Electric Propulsion.

READ AT THE GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, CHICAGO, JUNE 6-8, 1892, BY H. WARD LEONARD.

In the distribution of electricity from a power station for the operation of electric railways the only commercial method to day is by the use of a system of constant electromotive force operating the motors in multiple arc with each other, and at the present time every consideration of economy and automatic regulation seems to indicate that the constant electromotive force multiple arc system will always be the best for such distributions.

In the use of electric energy by motors operating under conditions of varying speed and torque the best results as regards economy and regulation are obtained when the electric energy utilized has a voltage varying directly as the speed and a current varying directly as the torque, for it is evident that under these conditions the electric energy required will be always proportional to the power developed.

If we could operate from the constant potenial system of shunt wound motor running at a constant speed and could interpose between this motor and the axle some device equivalent in its effect to an infinite number of different sets of mechanical gears, so that we could make use of any reduction desired, it would enable us while using a constant power to increase the torque as we decreased the speed, and *vice versa*, which is just what is desired in railway practice where the least torque is required when at full speed on the level and the greatest torque is required at the slow speed in starting and in operating on a grade. Numerous and very ingenious devices have been invented for accomplishing this variable mechanical reduction, but, on account of the complication, noise and unreliability, they have never proved successful.

The writer has recently devised an electrical method of securing all the results which could be obtained from such a set of gears described, with a freedom from the noise, wear, complication and rigidity which such a set of gears would necessarily involve.

Following is a general description of the arrangement proposed, as indicated by Fig. 1:

FIG. 1.

T. Trolley.
M. Motor portion of power converter.
G. Generator portion of power converter.
P. The propelling motor for the car.
R. The regulating and reversing rheostat in field of G.
E. The connection to ground.
W. The car wheel.

Each axle is driven by a gearless motor, either directly or by means of a connecting rod. The fields of these motors are excited directly from the constant electromotive force of the line and independently of the armature circuit. Beneath the car and between the axles there is suspended a motor generator, each armature winding being in a separate field. The motor portion of the motor generator—which will, for convenience, be called the power converter—is shunt wound and connected just as a shunt motor is for use upon ordinary constant potential circuits. The field of the generator portion of the power converter has its field connected across the line and has inserted in it a regulating and reversing field rheostat. This field circuit is independent of the armature circuit. The generating armature of the power converter is in metallic connection with the armatures of the gearless propelling motors. It will be noticed that this circuit, including the armature, is a distinct and separate metallic circuit having no connection with the line in any way.

Suppose now that our shunt motor is running at full speed and that our controlling rheostat in the generator field circuit is at its central position, so that the generator field circuit is broken. Although the generator armature is being driven at full speed, it is revolving in a field having no magnetism except the residual magnetism, and hence produces practically no volts. Let us now move our controlling switch so as to place the generator field across the line, but with a resistance in series with the field of 10 times the resistance of the field coils. We now get a slight excitation of the field and a development of volts at the brushes of, perhaps, 40 volts. This voltage will produce a current through the armatures of the driving motors dependent upon the ohmic resistance of this circuit only; and hence, even even at this low voltage, a large current will be produced, which being in a field of full strength will cause a torque sufficient to start the armature. The speed of the armature will, of course, be governed by the counter electromotive force which its revolution produces in its strong field; and hence, just as in the case of a shunt wound motor, its speed will be practically constant so long as the electromotive force supplied is constant.

If we now gradually increase the magnetic field of the generator by cutting out resistance by moving the controlling switch, we will gradually raise the electromotive force of the armature circuit, and with it the speed of the driving motors. Since these armatures are revolving in a constant field, the torque they produce will be exactly proportional to the current in them, and the current will automatically flow exactly as is required to produce the necessary torque to maintain a speed such that the counter electromotive force will approximately equal the electromotive force supplied by the power converter. Thus it will be seen that the speed of the car will be dependent upon and proportional to the electromotive force supplied by the power converter, and the torque or tractive effort will be dependent upon and proportional to the current supplied by the power converter.

Let us suppose that 60 amperes flowing through the armatures in fully excited fields will produce a torque sufficient to move the load when upon a grade. It is evident, from what we have seen, that 40 volts from the power converter will produce this current. Hence, by an expenditure of 2,400 watts in the secondary circuit, or a total power, including field excitation, etc., of about eight horse-power, we can start a fully loaded car upon a grade.

Under the existing systems, we would need the same 60 amperes in the same fully excited field, but would necessarily use the full voltage of 500 volts and, therefore, consume energy represented by 30,000 watts,

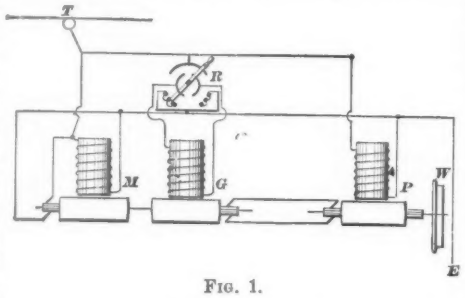


FIG. 1.

as against, possibly, 6,000 in this system. The current from the line in starting the car under ordinary conditions by this system would be about 12 amperes at 500 volts, instead of from 60 to 100 amperes at 500 volts.

In practice, the controlling switch lever can be instantly thrown from its central position to its extreme position for full speed. The field magnetism of the generator is rapidly increased, and, consequently, also its electromotive force, which in turn causes a gradual acceleration of the car.

The current in the armature circuit, and consequently the torque, is quite large in the beginning; but the electromotive force at this time is quite low, so that the total watts are low; as the inertia is overcome and the counter electromotive force begins to approximate to the impressed electromotive force the current falls off and finally becomes constant at an amount necessary to produce the torque required to maintain the speed. The current from the line, and hence the power, gradually increases from zero to the amount required at full speed, but at no time, either at the start or during the acceleration, is the energy from the line greater than that required when we are operating at full speed. It will be noticed that the effect is the same as though we first operated through a set of gear wheels, giving an extremely great reduction of speed and then rapidly changed the ratio of gearing, until finally we operated at full speed, with no reduction.

With our hypothetical gears we could, when running at speed, rapidly increase the ratio of gearing so that the movement of the car would tend to drive the shunt motor faster and faster. This would convert it into a generator forcing current back into the system, which production of electrical energy would act as a brake and gradually bring the car to rest.

Just so, if, when running at full speed, we suddenly place our switch lever at its central position the field of the generator will gradually reduce the strength and the counter electromotive force of the propelling motors will soon exceed that of the generator. The momentum of the car will now be driving our gearless motors as generators, which will supply current to the former generator, operating it as a motor, causing it to drive the shunt motor coupled to it as a generator, which, in supplying energy to the line, will act as a brake, and smoothly but rapidly bring the car to rest by converting the energy stored up and represented in the movement of the car into electrical energy, which will tend to relieve the work at the central station. Similarly, a car descending a grade and tending to accelerate in speed can be made to move at any desired speed without the aid of any mechanical brakes and the energy represented by its falling weight will be converted into electric energy and the car will become a moving feeder supplying energy to assist the generators at the central station in the operation of other cars.

It will be evident from what has preceded that with this power converter system we can propel a car upon any practicable grade with a consumption of power no greater than is required to operate the car at full speed upon a level, by merely reducing the speed to the required extent.

In street railways of from five to ten cars this is of great importance, for it means that we can equip a road with about six horse-power per car, as regards the engines and dynamos, and that our conductors can be reduced to about one-third of the amount at present necessary, for we will never require more than 20 amperes at the distant point, where to-day we have to provide for 60 amperes with the same loss and same initial electromotive force.

Under the rheostat system the plant is severely taxed when an unusual crowd must be moved from a certain point, and it is then, when it is of the greatest importance that no break-down should occur, that it usually does occur. With this power converter system we could, upon a five car road, start up and move with perfect safety 10 or even 20 cars from the most distant point on the road, though, of course, at a reduced speed, but the crowd would be handled with perfect success and without subjecting any portion of the plant to any unusual strain.

In the large cities it is no unusual sight to see an electric car moving at the slowest possible speed for, perhaps, several blocks. Perhaps 12 amperes are required to obtain the necessary torque. This at 500 volts is 6,000 watts. The power required for this slow motion by the proposed system would not exceed one-fifth of this amount.

Following is a tabulated statement (Table 1) showing the results we may expect to obtain by this system in operating with fully loaded car under three different conditions. First, at 12 miles per hour on level; second, at three miles per hour on five per cent. grade; and third, at one mile per hour on level.

In arriving at the losses, as indicated, the motor part of the power converter has been assumed as having the following features:

Electromotive force, 500 volts; current capacity for 10 hours' continuous duty, 15 amperes; resistance of shunt field winding, 1,000 ohms; armature resistance, 1.1 ohms.

The generator portion of the power converter and the driving motor are assumed as having the following features:

Electromotive force, 500 volts; current capacity for 10 hours' continuous duty, 40 amperes; resistance of field, 900 ohms; armature resistance, 0.55 ohm.

The rolling friction with gearless motors on good level track is assumed as 20 pounds per ton. Car is assumed to be eight tons in weight full loaded and five tons for moderate load.

We find that with 12 tons moving at 12 miles per hour on a level we will require 12.6 amperes which is practically the same as by present series motor systems. With eight tons moving at three miles per hour upon a five per cent. grade 22.5 amperes will be required, which is about one-third of the power required by present systems. With eight tons at one mile per hour on level 2.8 amperes will be required, which is about one-fifth of by present systems. With five tons moving at five miles per hour on five per cent. grade 18.5 amperes will be required, which is about 40 per cent. of the power required by present systems.

Let us examine some of the advantages that this method seems to offer over the existing methods, starting at the car and considering the entire equipment back to the boiler.

In order to place before you the opinions of some of the best authorities on the questions involved, I shall quote freely from "The Electric Railway" (Crosby & Bell); Parshall's "Methods of Electrically Controlling Street Car Motors;" "Comparative Test of High and Low Speed Engines in Electric Railway Work," by Charles W. Wason (*Electrical Engineer*, April 27, 1892); "The Practical Operation of the Gearless Motor," by S. H. Short (*Electrical World*, April 16, 1892); "Load Diagrams of Electric Tramways and the Cost of Electric Traction," by A. Reckenzaun (*Electrical Review*, London, March 25, 1892).

The cost of car equipment will be increased by the cost of the motor-generator, but as a partial offset to this we have saved the rheostats, two expensive controlling switches and a complex system of wiring.

Our motors, having constant and fully-excited fields, will operate absolutely without spark under all conditions. The control of the car will be entirely accomplished by a small switch and rheostat, handling never more than one-half of an ampere and occupying a space of one foot square and one inch deep over all.

As regards efficiency, we will have the advantages of the present system under all conditions. For long runs upon the level

we will, by a suitable switch, connect the driving motors directly to the line and secure an efficiency of 90 per cent. for our motor.

As regards depreciation, we will have the advantage of no rheostats or controlling switches to burn out, and with no sparking and no connection with the field circuit we will have the minimum liability of burning out armatures.

Our fields will have no tendency to burn out, since they are not subject to the excessive currents which the present series fields are. The current in our fields will be independent of the load.

As to field windings and rheostats in existing methods, Parshall says:

"With 25 horse-power motors an external resistance of 10 to 12 ohms is required.

"Lessening the duty of the rheostat is a very important point, since as yet it has been found exceedingly difficult to construct a cheap rheostat that could be placed under the car in the small space available and dissipate so large an amount of energy as is required when the car is to be run for a considerable time at a speed so low as two or three miles an hour. Any method of control that has lessened the energy to be dissipated in the rheostat has in general been considered with favor, since there has been a corresponding diminution of trouble in each case that the energy to be dissipated has been lessened.

"The range of speed without the use of a rheostat is determined by the limit to which it is safe to heat the magnets."

Crosby & Bell say:

"In using this method (commutated fields) the principal difficulty has been met with in disposing of the excessive heat necessarily generated in the compact mass of field windings.

"The practical problem has been to secure a convenient rheostat.

"The principal sources of loss in our present street railway motors are the regulating devices and the gearing.

"With the motors and the gearing generally employed the average commercial efficiency of the combination is probably not often in excess of 65 per cent., giving a total commercial efficiency for the system, from engine to car wheel, of 39 per cent.; this, of course, is but an estimate. But, taking all the factors into consideration, it is probable that the average of the roads now in operation would fall quite nearly to the point indicated. In very few cases would it fall below 30 per cent.; in still fewer would it rise about 40 per cent."

Regarding the power needed to start a car on existing methods and to operate it upon level and grades, Crosby & Bell say:

"With the ordinary car equipment of two 15 horse-power motors, and the usual speeds, from eight to 12 miles per hour, experience has shown that five to six electrical horse-power is necessary on nearly level tracks."

"The amount of current ordinarily taken in starting a car is momentarily more than 50 amperes, which at the ordinary voltage corresponds to about 25,000 watts."

Reckenzaun says:

"If we calculate from the accepted coefficients of resistance to traction on common tram rails, we find that an ordinary tram-car will require but three to four horse-power for its propulsion when once in motion."

He says of the Thomson-Houston car:

"The maximum current at any time was 75 amperes."

Of the Sprague motors.

"Here again we observe a maximum current of 75 amperes. Westinghouse motors, maximum current 95 amperes."

Short finds that 80 to 100 amperes are required to start a car, and says:

"On this road the traffic is very heavy, although grades are light."

Leaving the car, let us now consider the line. It will be evident from what we have seen that we can reduce the amount of copper to one half the present requirements, as we never will require the enormous currents at present called for in starting and upon heavy grades. Or, to put it in another way, with the existing conductors we could run twice as many cars as at present, with the same loss in the conductors.

Now, let us look at the generators and the prime movers, whether steam engines or water wheels.

Under existing systems for roads of from 5 to 10 cars, it is necessary to install about 20 indicated horse-power (rated at ¼ cut-off) per car, and about 16 kilowatts per car in generators. Also about 20 horse-power per car in boiler capacity. This large equipment is necessitated by the occasionally very large demands for power and the inefficiency consequent upon this.

Under the proposed system it is not necessary to provide power in excess of 15 horse-power for any car under any conditions, and since in practice most of the cars will be operating at less power than this, we need only install engine, dynamo and boiler capacity of 8 horse-power per car, instead of 20. Or, to express it in another way, we can operate with existing boilers, engines and dynamos at least double the number of cars they can at present supply.

Crosby & Bell recommend, for a five car road:

"An equipment consisting of two 40,000 watt dynamos, one 80 horse-power, high speed, simple engine belted directly to them

FIG. 1.—WESTERN ELECTRIC COMPANY'S TELEPHONE RECEIVER.

and two boilers of about 50 nominal horse-power each."

Now, let us look at the economy of the operation of the station. With the extremely fluctuating loads of existing systems, the economy of the entire generating plant is very low. The stations of three roads which have been tested give for the combined efficiency of engine and dynamo 40 per cent., 54.6 per cent. and 62.8 per cent., respectively. If the load can be kept approximately constant, the combined efficiency of engine and generator should be about 75 per cent., and in the proposed system the load will be sufficiently uniform for us to expect an efficiency equal to this, and because of the nearly constant load we can produce a horse-power on about 25 pounds of water, while in present practice for small roads about 50 pounds of water per horse-power is a fair figure and the best published result thus far obtained, even when the average

FIG. 2.—MIX & GENEST'S TELEPHONE RECEIVER.

horse-power rose to 750 horse-power, is 28 pounds per horse-power, as found by Wason, at Cleveland, in operating a total of 71 motor cars.

With the present systems the average indicated horse-power per car is about 12 horse-power, which, on account of fluctuating load, requires at least 36 pounds of water per horse-power, or about 420 pounds of water per car per hour.

With the proposed system we will operate with an average of about eight indicated horse-power per car, which, on account of the steady load, will be produced with about 25 pounds of water per horse-power, or 200 pounds of water per car per hour. That is, we require about 50 pounds of coal per car per hour by present systems, and about 25 pounds of coal per car per hour by the proposed system, or a saving of 50 per cent. in the coal and water required in favor of the proposed system.

On this subject of fluctuating loads and their effect, Crosby & Bell say:

"A record of 10 minutes on a recording ammeter may give some faint idea of the condition of things. It will be seen that at one point the output jumped from zero to 150 horse-power and back inside of a single minute, and during the latter five minutes shown in the diagram there were no less than 25 sudden *variations* of 50 to 100 horse-power each taking place within a few seconds. The road from which this record was obtained is four miles in length, and was operating seven cars at the time of the test."

Reckenzaun says:

"These abrupt changes have the effect of reducing the efficiency of the whole system to a comparatively low figure."

Church says (*Electrical Engineer*, April 27, 1892) that the best compound engines will show an economy of only 28 pounds, and the usual compound engine "an average duty not better than 35 to 40 pounds. The same is true of every form of non-compounded engine, whether high speed or low speed, both of which show a tremendous falling back of fuel duty under variable load."

Let us now examine the comparative first cost of a railway of moderate size, say from five to ten cars, equipped by present systems and by the proposed system.

The detailed figures per car are given in Table 2.

TABLE 1.—DUTY OF CAR, SHOWING VARIOUS LOSSES EXPRESSED IN WATTS.

Various Losses Involved.	8 Tons at 12 Miles per Hour on Level. Full Speed, ¼ Full Torque; Armature Current, 10 Amperes.			8 Tons at 3 Miles (or 5 Tons at 5 Miles) per Hour on 5 per cent. grade. ¼ Full Speed, Full Torque; Armature Current, 60 Amperes.			8 Tons at 1¼ Miles per Hour on Level. ⅛ Full Speed, ¼ Full Torque; Armature Current, 10 Amperes.		
	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.	Power Converter.		Driving Motors.
	Motor part.	Gen. part.		Motor part.	Gen. part.		Motor part.	Gen. part.	
Field	250	275	250	250	60	250	250	25	250
$C^2 R$ in armature	160	60	60	250	2000	2000	20	60	60
Friction	60	60	120	60	60	30	60	30	10
Foucault currents, hysteresis, etc	200	400	400	200	50	50	200	10	10
Total	670	795	830	760	2170	2330	530	125	330
Total watts wasted	2295			5260			985		
Watts of work done	4000			6000			400		
Total watts absorbed	6295			11260			1385		
Amperes at 500 volts	12.6			22.5			2.8		

TABLE 2.—SHOWING PROBABLE COMPARATIVE FIRST COST PER CAR BY PRESENT AND PROPOSED SYSTEM.

	Present System.	Proposed System.
Steam plant, generators and conductors per car (steam plant 1,000, generators 700, conductors 500)	$2200	$1100
Motors (two 15 horse-power equipments)	1800	1400
Power converter		900
Controlling switches, cables, rheostats, etc	200	30
Total first cost per car	$4200	$3430
Saving in favor of proposed system per car		770

Table 3 gives a summary showing the features of the proposed system as compared with the corresponding features of the present system.

TABLE 3.

	Present System.	Proposed System.
First cost of steam plant, generators, conductors and car equipment per car	$4200	$3430
Amperes at 500 volts required to start full load on level	75	2.8
Amperes at 500 volts for full load at full speed on level	12.5	12.5
Amperes at 500 volts to start full load on 5 per cent. grade	125	10
Amperes at 500 volts for working speed on 5 per cent. grade	60	22.5
Amperes fed back to system in coming down 5 per cent. grade	0	10
Pounds of coal per car per hour	50	25

The features of the proposed system which seem, at first sight, to be very objectionable are: The increased cost of the car equipment and the fact that we are adding an additional machine, having two fields, two armatures and three bearings; but, as we have seen, there is only an apparent increase in the first cost, for the saving in the generators and distributing plant far exceeds the additional cost of the car equipment; and the use of the motor-generator for elevators, traveling cranes, etc., has demonstrated that, as regards the attention it requires and the depreciation it suffers, it has a marked advantage over the rheostat or commutated field used in the present methods of operation.

TELEGRAPHIC

.... Four additional copper wires are being strung by the Postal Telegraph Company from Pittsburgh to Philadelphia.

.... The new line of the Western Union Telegraph Company to Snohomish, Wash., was opened for business recently. Construction is being continued along the Lake Shore road to Sedro.

.... The Western Union Telegraph Company furnished free public bulletins during the Republican convention at Minneapolis. The same policy will be followed during the Democratic convention at Chicago.

.... The contract for building the telegraph line along the entire route of the Everett and Monte Cristo road, a distance of 45 miles, has been let to Prof. Leo Daft, the electrical engineer of Seattle, Wash.

.... What is described as the biggest signal box, or switch tower, in the world, that is, from which the largest number of switch and signal levers and electric signals are operated, was opened in London two weeks ago. It is at the Waterloo station, where 22 tracks run to as many platforms and sidings. The switching and block signaling arrangements are to be controlled in the new box. On the day of the Universities' boat race 819 trains passed the old box between daybreak and midnight, an average of 45 trains an hour. The handling of that traffic required 18,000 distinct lever motions and 20,000 electrical signals. In four hours 173 switching operations were performed from the box. The old box was too small for the work required.

Telephone Receivers at the Crystal Palace Exhibition.

The English electrical journals have been devoting considerable space to the electrical exhibition at the Crystal Palace. One of the most interesting classes of exhibits is that devoted to telephone receivers. We present herewith illustrations of two examples, reproduced from our London namesake. Fig. 1 illustrates the pattern exhibited by the Western Electric Company. A square base is provided made of ebonized wood, walnut or mahogany. The transmitter is of their granular form, and is mounted in such a way as to admit of being turned in any direction, independent of the position of the base upon the table when the apparatus has to be brought into use. It is also fitted with their latest form of switch lever, designed to afford greater security to contact between the lever and springs. A double-pole bell receiver is provided to complete the instrument, and forms, with the granular transmitter, a very powerful telephonic combination.

The latest instrument of this kind, produced by Messrs. Mix & Genest, is of very artistic design and is shown in Fig. 2. It is arranged for calling by battery current, a press button and battery replacing the magneto generator usually provided. The bell is concealed underneath the base, and the standard, which is cylindrical, encloses the induction coil. The microphone is fixed in a slightly slanting position. The combination is completed by a watch receiver suspended from the switch hook which projects from underneath the transmitter.

At the National Telephone Company's stall may be seen an elegant table telephone of the Ericsson-Bell type, manufactured in Sweden, and illustrating the class of apparatus used in that country. It is provided with a granular transmitter, very similar to that manufactured by the Western Electric Company, and a double-pole Bell receiver. The design and general appearance of the complete apparatus is excellent, and the workmanship is of a quality superior to that usually found in telephonic apparatus. The transmitter is mounted upon a revolving arm which describes a complete circle, and the stand containing the magneto-generator runs upon India-rubber rollers, which admit of the complete instrument being noiselessly moved about upon the table or desk. An Ericsson-Bell wall telephone is exhibited at the same stall, and in this instrument, also, the design and the workmanship are alike equally excellent with the table instrument.

* * The Pennsylvania Railroad Company will experiment near Baltimore to exclude gas and smoke from tunnels with an electric fan.

* * The new owners of the South Orange, N. J., street car line promise to have it equipped with electricity and in running order by August 15.

* * The Belt Electric Line of Port Townsend, Wash., has been attached in the United States District Court at Seattle, and Isaac Ross appointed receiver.

* * Property owners along the Providence Road, Delaware County, Pa., want the new electric railway to be run through the fields and not upon the highway.

* * The management of the Edgar Thomson Steel Works, at Braddock, Pa., have made a complete test of the electric apparatus which is applied to working the drawing and charging buggies in the mill, and the change in machinery will be made immediately.

* * Judgment for $2,108 was entered June 6 against the Gibson Electric Company, of No. 74 Cortlandt street, New York, in favor of Henry D. Donnelly, on promissory notes and for services as counsel. The company was incorporated on February 5, 1886, to manufacture storage batteries. Its factory at Chatham, N. Y., was destroyed by fire last Fall.

* * John D. Crimmins, the well known contractor, has sent a letter to all the New York newspapers, asking that it be understood that his proposition to introduce the trolley system on surface cars in this city is his individual opinion, expressed in spite of the public disapproval, which he knows to exist, because he believes that it is the best system of transit yet devised.

* * The joint committee of the House of Lords and the House of Commons has reported to Parliament that, after thorough examination of the subject, it considers electricity a suitable and efficient source of motive power, and a recommendation is made that the progress of the electric railway should not be impeded, but that, on the other hand, the construction of lines should be encouraged.

Electricity and the Law.

Electricity seems destined to afford lawyers of all lands an opportunity of showing their professional skill at splitting hairs. In America several legal questions have cropped up. Is electricity dutiable? Can it be stolen? In France it was a moot point, until a short time ago, whether an electricity supply company was a Société Civile or a Société Commerciale, a matter of no little importance to investors, who, in the latter case, would only be liable for the amount of their shares, says the London *Electrician*. A Société Commerciale, it appears, is one which has for its principal object "the accomplishment of acts of commerce," such as buying raw material and reselling it at a profit, manufactured, or in its natural state. The Edison Company of Saint Etienne, summoned before the Tribunal of Commerce of that town by one of its customers, declined to submit to the jurisdiction of the court on the ground that the supply of electricity from a central station did not constitute a commercial act, "the company only sold a product which it gathered from nature, and which was a *res nullius*." The Tribunal of Commerce, nevertheless, declared itself competent to try the case, and on appeal its decision was upheld; so that in France, at any rate, electricity, when supplied from a central station, must be deemed a manufactured article. Across the Atlantic, where the manufacturing interest is dealt with very tenderly by the tax gatherer, a similar decision would add appreciably to the profits of central stations.

Edison Electrical Controlling Table for Street Railway Stations.

In the operation of electric railroads not the least point for consideration is that of facility and rapidity of control of the electric power generators. Until recently the large switchboard has been employed, necessitating extreme agility on the part of the electrician in charge to bring the output of his generators to the desired point, and this plan has been found not only cumbersome, but expensive. Improvements were therefore looked for.

In order to secure a thorough, effective and rapid control of the generators in an electric railway station, a new device has been gotten up, known as the railway controlling table. On this are mounted all the regulating and indicating apparatus in the most compact and convenient space possible. The frame work is of strong bar iron. The lower part of the front of the table and the two ends are of sheet iron, ornamented with a moulding in relief. The table top, upper part of the front and the upright back piece are, in the table illustrated, of polished Tennessee marble, but this is an exceptionally fine piece of work. The more frequent custom is to have these pieces made of polished or plain slate. In front are the dynamo field regulators, operated by wheel handles and duly numbered in reference to the machines they control. On the table are mounted the cross-bar snap-switches—new style switches recently designed—the dynamo fuse blocks and the equalizing bar switches, one of each for each dynamo; a voltmeter of the Weston type and a voltmeter switch of the regulation pattern.

On the upright back piece are the ampere meters and the galvanometer. These instruments merit particular mention. The ampere meters are of the standard Edison type, the solenoid of bar copper highly polished being mounted directly on to the marble. The covers are of polished brass with moulded edges, in which are set the beveled glass fronts.

The galvanometer shows when the voltage of the current of one of the generators about to be switched into circuit is the same as that from the other machines already supplying the circuit. It consists of two coils arranged one on either side of a pivoted indicating needle of soft iron. This needle is polarized, it being pivoted within a piece of steel previously magnetized. If the voltage of the current from the generator ready to switch into the circuit is too high or too low, the deflection of the needle indicates the fact, so that the field regulator can be adjusted until the voltage is correct, when the needle presents no deflection. This instrument is mounted directly on to the marble, its cover being similar in style to those of the ampere meters just mentioned.

With this controlling table in the station, the electrician has no difficulty in swiftly regulating his output of current to meet the varying conditions under which the road may be working. With one hand on the snap-switch handle and the other on the wheel of the field regulator, an almost simultaneous movement is possible, and control is thus immediate. The table shown was designed for four generators, and was invented and constructed by the Edison General Electric Company.

Edison Controlling Table for Electric Railway Power Stations.

Flash-Lights for Mars.

Probably the most intelligent suggestion yet thrown out for exchanging signals with the inhabitants of the planet Mars, if any such there be, is made by Mr. E. Ellsworth Carey, says the Chicago *Tribune*. It is that a perfectly level area, say at least five miles in diameter, not in the vicinity of hills or mountains, be covered with a uniformly black coating of earthy sand or coal dust. This area is to be covered with gas jets or electric arcs, placing the illuminating points about three feet apart. That would require some 6,000,000 points of intense brilliancy, visible to the inhabitants of Mars, with a magnifying power of 300 diametres when the earth was sufficiently far away from conjunction to be seen while the sun was below the belt of twilight.

The plan is to so construct and connect these signal lights that the turning of a key would instantly extinguish or light them all. Then the illumination should be made to appear and disappear at regular intervals. Suppose, at first, the interval between the flashes was three seconds and the flashes continued five seconds. Then the intervals and duration of light should be changed, say, to six, twelve, eighteen, etc., seconds, and then the series of intervals reversed. Mr. Carey argues that such signals would hardly be kept up long without attracting attention on Mars, if its inhabitants be far advanced in intelligence, development and civilization. They must then conclude that the earth is similarly inhabited, and that some of its people had constructed a flash-light visible to dwellers on Mars. It also may be expected that they would arrive at the conclusion that such light was maintained as a signal to attract their attention. Further, it may be supposed that in the latter case they would make arrangements to return the signal, if possible, though some, perhaps many years might elapse before they could respond in a manner we should understand.

This is a pretty theory, and its author deserves credit for having been the first to show the world how interplanetary communication is possible. But there still remains the question, Is it practicable? For the present, at least, that must be answered with a decided negative. It is not likely that any man, or association of men, would undertake the enormous expense involved in carrying out this scheme, seeing that there is in it no suspicion of profit, and but a problematical amount of glory, not to be gained till perhaps years after the death of the investor. If a generation should ever arise on this earth that loves wisdom more than wealth it may find other uses for its money than in trying to bridge the gulf that separates us from the other members of the solar system, but till then it is idle to expect the costly effort to be made. Still it will do no harm for the enthusiastic ones to revel in anticipation of some such result to be achieved by those who will come after them, and there is another view of the case still more enticing to those who are speculatively inclined. Some of the philosophers who have studied the appearance of Mars think there is reason to suppose its inhabitants are much further advanced than ourselves in the march of intellectual progress, that planet having cooled down from the original nebulous heat sooner than its larger brother or sister, the earth. Hence it is not absurd to suppose the inhabitants of Mars already have been considering the problem of intercommunication with other members of the solar system, and for aught we know they may have been making such signals to us for centuries past without our being aware of the fact. If some of the lynx-eyed ones who scan the objects in the sky through telluric telescopes once see changes on the surface of Mars which they fancy indicate that signals are in progress, the case would be radically altered. It might not then be impossible to find persons willing to stand the immense cost of setting up and conducting a return telegraph apparatus, by means of which we may acknowledge the salute and raise ourselves in the estimation of our neighbors.

OBITUARY.

R. Zuller, for 25 years manager of the Western Union Telegraph Company's office at Hoboken, N. J., is dead.

Peter Williams Willans, well known in England as a designer of high speed engines for electric light service, was recently killed by being thrown from his trap while driving.

George F. Green, a well-known inventor, has died from intermittent fever at Kalamazoo, aged 60 years. He had made a number of important inventions, and recently had been working at a new electric car system.

Robert J. Anderson, one of the best known citizens of Pittsburgh, died there on June 2. He was born on April 18, 1827, and was a pioneer steel manufacturer. With Andrew Carnegie he was a director and promoter of the Atlantic and Pacific Telegraph Company, and he drove the silver spike at Omaha to celebrate the completion of the Union Pacific Railroad.

Train Lighting.

Of the three systems of train lighting—direct driving from a small engine; discharge from accumulators without engine or dynamo; and dynamo driving from an axle—the last seems to be the most promising, according to an editorial in the London *Electrician*. Accumulators are necessary to supply the lights not only while the train is at rest, but when it is running at a speed too slow to drive the dynamo at a useful voltage. The charging of the batteries is effected only while the train is running above this speed, and, of course, only during the daytime. The ratio of the period during which charging is possible to the period during which the batteries are called upon to supply the current determines the minimum speed. This varies widely on different lines, and with different trains and classes of trains. Neither engineers nor traffic managers are able to give accurate information on that point, and several failures have been due to neglect of this consideration. Increase of speed above the minimum does not contribute any useful effect, but has to be neutralized by the action of a governor introducing resistance in the fields, or rocking the brushes; or by some other means for preventing a rise of the voltage, such as a second dynamo, or compound winding with back turns. Such a governing apparatus has only a limited range, and varies from one to three or one to four. The Holmes' double dynamos on the Midland Railway cut in when 25 miles an hour is attained, and maintain a constant pressure of 50 volts up to 75 miles an hour. The full pressure is thus attained at one-third of the maximum speed. The governing arrangement of Mr. Houghton, of the London, Brighton and South Coast Railway Company, adapted to a Brush dynamo, enables the dynamo to begin to generate at one-quarter of the full speed. If this were equivalent to the effective working of the dynamo during two-thirds or three-quarters of the whole of the journey there would be little or no difficulty. It is not a question of mere speed, for the gear could be adapted for either fast or slow trains; but the difficulties arise with trains stopping at many stations, when it will be found in a large number of cases that the period during which charging is possible is less than that during which the batteries are called on to provide current, unless a very wide range of working of the dynamo is arranged for. With a wide range the dynamo must be larger, for it must be able to do the whole work at a slower speed. Another difficulty arises when trains have to be broken up; the batteries are then subjected to unequal charge and discharge, and unless there is very ample provision for charging they are sure to deteriorate.

A year ago there were 16 electrically lighted trains on the Brighton line, and six more were being fitted; on the Great Northern there were six, and two were being fitted; and on the Midland there were eight main-line and two local trains, making, according to Mr. Langdon's paper on the subject, a total of 365 coaches and 57 vans electrically lighted. The Brush Electrical Engineering Company have supplied some 60 dynamos for train lighting which may be said to have advanced well beyond the experimental stage. Notwithstanding the success and increase of this branch of electric lighting, it must be remembered that it presents most unusual difficulties and should not be attempted, as has often been done, without most careful consideration of the conditions of each particular service. The early attempts in this direction were sometimes entrusted, after they had left the hands of the contractors, to the supervision of telegraph superintendents, who, unlike Mr. Houghton and a few others, knew nothing of dynamos or accumulators.

The various advantages which electric light presents in domestic illumination are not felt in train lighting, since the products of combustion of either gas or oil lamps are got rid of; and no accident has yet resulted from the use of compressed gas. The lighting of the London and Northwestern trains running from the Mansion House to Broad street is hard to beat; but the gas is very costly, and an expensive generating and charging plant has to be provided. It is remarkable that the value of electric lighting in connection with the two great systems of steam locomotion should differ so widely. It is simply indispensable on passenger steamers, where it is the greatest boom, and if the cost were double it would make little or no difference; and it is, moreover, easy to arrange and fit, there being no need for batteries or regulation. In passenger trains, on the other hand, the difficulties are peculiar, the mechanical and electrical details are very complicated, the light presents no advantages to the passengers, and the whole thing is simply a question of relative cost.

Lighting Combination at Kansas City.

The Kansas City Gas and Electric Light Company has just been chartered, with a nominal capital of $10,000. It is a consolidation of the Kansas City Gas Light and Coke Company, the Kansas City Electric Light Company, the Edison Electric Light and Power Company and the American Electric Light Company, all of Kansas City. The incorporators are: George H. Nettleton, J. S. Chick, Edward H. Allen, S. B. Armour, M. J. Payne, E. R. Weeks, E. L. Martin and George Kumpf, of Kansas City, and Randall Morgan and S. T. Bodine, of Philadelphia.

This company will soon apply to the city council for a 30-year franchise to operate its business in Kansas City. The State franchise granted to the Kansas City Gas Light and Coke Company will expire in a short time. The new company proposes to give the city a percentage of the gross receipts in consideration of the franchise.

The Electric Light on Battlefields.

The ubiquity of electricity is becoming almost proverbial. From the "brightest spot on earth" to the bloodstained battlefield is rather a far cry, but there is no end to the application of electricity. A recent telegram from Gratz, by Reuter, described some experiments of great interest which have recently been carried out successfully there. The difficulty of searching for the wounded on the night after a great battle has been one which has long occupied the attention of military reformers, and the Army Medical Service, in Austria, has been endeavoring to determine how far the electric light may be utilized for this humane end. The value of powerful search-lights with reflectors has been proved in naval affairs, and at Suakim and elsewhere our soldiers have found them very effective on open ground, says our London namesake. They would be equally effective, under similar conditions, for assisting in picking up the wounded, but when the battle has raged over a wide extent of country, or when the fighting has occurred amidst woods and brushwood, the use of this class of light is attended with difficulty. The need for a special form of light for this purpose having been recognized, the Austrian Medical Service have been experimenting with portable electric lanterns fed by secondary batteries contained in the knapsacks of the men who carry them. These experiments have been carried out under conditions as nearly as possible similar to those which would occur in actual warfare, and the results were so encouraging that it is highly probable that the portable "search-light" will be taken up in earnest by the military authorities in other countries.

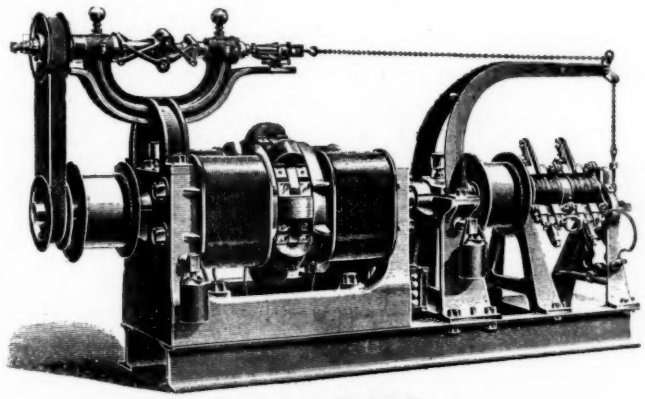
An English Train Lighting Dynamo.

The electric lighting of trains has not, on the whole, received the attention it deserves. In the early days of electric lighting the illumination of trains electrically was neglected by the larger and more competent firms, and fell to a large extent into the hands of men with more enthusiasm than knowledge, and this has kept it back very much. Of late it has fallen into better hands, and there is more chance of solid progress in that direction.

The accompanying illustration, which we reproduce from London *Industries*, represents a general view of a train lighting dynamo, as constructed by the Brush Electrical Engineering Company, Limited, London and Loughborough. This plant is the outcome of eight years' experience, during which time the Brush Company have supplied about 60 such dynamos for train lighting purposes. For this class of work the special feature required is a constant electromotive force with wide variations of speed. For a threefold variation of speed—from about 500 to 1,500 revolutions—the electromotive force only varies two per cent. with this dynamo. The plant is entirely automatic, only requiring the guard to turn the lights off and on when desired.

The apparatus necessary for lighting a train consists of dynamo, cells and controlling gear, the carriages being usually wired with all the lamps in parallel. The lights can be run from cells whether the dynamo and train are running or not. When the train is at rest the brushes of the dynamo are held free of the commutator, the lamps being supplied from the accumulator. The dynamo, which measures about six feet, by 17 inches, by three feet high, is driven from the axle of the guard's van by means of a belt. When the train starts—in either direction—the brushes are automatically brought into the correct position on the commutator, and connections are made which give the field the polarity to suit the particular direction of rotation. When the train has attained a speed sufficient to drive the dynamo at about 500 revolutions per minute, which is the speed giving the necessary electromotive force, a centrifugal governor shown connects a relay with the cells; this relay allows the cells to excite the fields, and when the latter are fully excited the charging circuit is closed by an automatic switch and charging begins. At the same time a small resistance is inserted in the lamp circuit to compensate for the difference of electromotive force across the mains, due to the cells being charged. From this initial charging speed the dynamo maintains a practically constant pressure up to the highest speed attained by the train, the usual range being one to three. That is to say, the dynamo begins to charge when the train is running at one-third of full speed, and continues to charge at all speeds above that. When this apparatus is at work, the pressure is practically constant, the governor gear appearing to work perfectly. The absence of sparking in this dynamo is effected by means of the centrifugal governor which, through the medium of a chain, rocks the brush holders in the proper direction against the pressure of a spring. This governor also answers the purposes of switching the dynamo in or out, and of closing or opening the exciting circuit at the proper speed.

The automatic devices are designed on a principle mainly worked out and patented by Mr. Houghton, telegraph engineer to the London, Brighton and South Coast Railway Company, who has been for many years so closely associated with the electric lighting of the trains on that company's lines.



AN ENGLISH TRAIN LIGHTING DYNAMO.

ELECTRIC LIGHT NEWS

—— Money is being subscribed for a carbon factory at Tonawanda, N. Y.

—— About $1,200 has been subscribed toward an electric light plant at Carrollton, Ky.

—— The electric light plant at Florence, Ala., has been placed in the hands of a receiver.

—— The Petersburg, Va., city council has unanimously decided to own its own electric light plant.

—— The electric light plant at Annapolis, N. S., was recently damaged by fire to the extent of $1,000.

—— Local capitalists will endeavor to establish electric light and water companies at Hammonton, N. J.

—— The General Electric Company will install 500 incandescent lights in Gilmore's Theatre at Springfield, Mass.

—— A receiver has been appointed for the Pontiac, Ill., Electric Light Company on complaint of one of the partners.

—— The electric light and water works power house at Rockport, Ind., burned on the morning of the 3d. Loss $4,000.

—— The Edison Electric Illuminating Company, of Oskaloosa, Ia., has leased the gas works at that place for five years from June 15.

—— The Woburn, Massachusetts, Electric Light Company will shortly begin the erection of a number of desirable dwelling houses on land owned by the company.

—— The Reading, Pa., Electric Light Company has made an increase of $30,000 in its capital, for improvements and increase of the capacity of the plant. The stock has been allotted to the holders, and is being issued at the par value of $10 per share.

—— Over $35,000 was spent in decorating the city of Denver during the Knights Templar Conclave. Twenty thousand colored incandescent lights were used along the principal streets and in Masonic designs. Search-lights were placed in prominent locations.

—— The municipal electric lighting plant recently installed by Mr. J. A. Seely, of New York, for the city of Wheeling, W. Va., has been accepted by the city. The total cost of the plant was $104,066.95, of which $85,420 went to the Fort Wayne Electric Company for apparatus.

—— The Brush Electric Company, of Baltimore, has elected the following directors: Messrs. Summerfield Baldwin, Dr. William Whitridge, Edgar G. Miller, Francis E. Waters, James E. Hooper, Lloyd L. Jackson, of Baltimore; George W. Hebard and Philip Ferd. Kobbe, of New York, and W. C. Clark, of Pittsburgh.

—— A lady in the Palace Hotel, San Francisco, requested the clerk to call a messenger boy. Not receiving a prompt answer, she concluded to "press the button" herself. The "button" she happened to select proved to be the electric light switch, and when she operated it the whole first floor of the hotel was thrown into darkness. When light was restored the lady had vanished.

—— The submarine cable connecting the dynamo station on Sandy Hook with the new electric light buoy on Southwest Spit, was laid last week under direction of Capt. W. S. Schley, the lighthouse inspector for this district. The cable is two miles long. The buoy it will light marks a sharp right angle turn for heavy draught vessels. The red incandescent light on the buoy will be displayed on and after the night of June 15.

KINDRED INTERESTS

The Office and Factory of the H. E. Swift Manufacturing Company has been removed to No. 1 Hartford street, Boston.

Five 100 Horse-Power compound condensing Armington & Sims engines, of the horizontal type, have been ordered by the Consolidated Electric Light Company, of Portland, Me.

The Case School of Applied Science, of Cleveland, O., held its commencement exercises in Case Hall, June 9. We have to thank the president and the faculty for an invitation to the exercises.

The Interior Conduit and Insulation Company, 42-44 Broad street, New York, have issued a code book for their illustrated general catalogue No. 7. Their customers who order by telegraph will find this code book practical and reliable, and it will save them money on their telegraph bills.

The Buckeye Engine Company, Salem, O., is sending out a very interesting three part catalogue describing Buckeye engines of all types. A large number of valuable tables and very interesting articles on the use of the steam engine indicator form an important feature of worth to all steam users.

William H. Bryan, M. E., late general superintendent of the Pond Engineering Company, will, in future, devote his time exclusively to the practice of his profession of mechanical and electrical engineering. He will do no selling or contracting of any nature, but will endeavor to serve the best interests of the purchaser. His offices will be at 56 Turner building, St. Louis.

Queen & Co., of Philadelphia, are just issuing a revised price list of their "Magnetic Vane" ammeters and voltmeters in which two forms are given, one with brass and the other with iron cases. The difference in price is occasioned only by a corresponding difference in material used, and external finish. Both types are calibrated to the same degree of accuracy These instruments are extensively employed for switchboard purposes, and enjoy an excellent reputation. As decided changes in appearance and prices have been made, it will be well for interested parties to obtain a copy of the special descriptive circular No. 330.

Messrs. Woodhouse & Rawson United, Limited, of London, have opened a branch office and show room at 22 Rue Lafitte, Paris, which will be the chief depot for their French trade, and all communications regarding the same should be addressed to Mr. E. Kenealy, the manager there, who will give them his prompt and careful attention. Mr. E. H. Cadiot no longer represents the firm in France. The Great Northern Railway Company have recently purchased the Victoria Hotel, Bradford, Eng., and have entrusted the complete decoration and refurnishing of it to the well known firm of Marsh, Jones & Cribb, of Leeds, the sub contract for the bell work and electric lights being in the hands of the Bradford branch of Messrs. Woodhouse & Rawson United, Limited. The current required is to be obtained from the Bradford corporation central station. The tender of the Bradford branch of Messrs. Woodhouse & Rawson United, Limited, for wiring and fitting the borough surveyor's office, at Huddersfield, has been accepted.

The Ries Electric Specialty Company, of Baltimore, are having such a large demand for the Ries regulating socket for alternating current incandescent lamps that it became necessary for the company to increase its facilities for making their regulating sockets. In order to meet the demand it was decided at a recent meeting held by the company, to increase its capital stock to $150,000, and we are informed that the stock was all subscribed for before the increased capitalization papers were issued. The Ries Electric Specialty Company are now making their sockets for all the standard makes of lamps, and for alternating current circuits of any voltage from 50 to 110. This socket is also having a very large sale to manufacturers of alternating fan motors, who recommend the socket highly, and claim it is the very thing that they have been waiting for to regulate the speed of their fan motors. The Ries regulating socket cannot be too highly spoken of, for it is one of these inventions that benefit the entire alternating current industry. This company have delightful offices at the corner of Eutaw and Baltimore streets, Baltimore, Md., and cordially invite any visitors to their city to make their headquarters with them while in the city.

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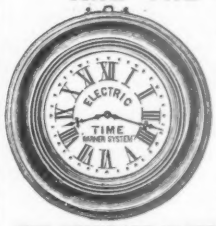
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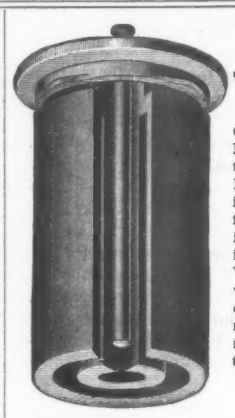
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Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.
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